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The Third Agricultural Conference at Peradeniya.

(Continued)

Wednesday, May 9, 1928.

Morning Session.

His Excellency the Governor said that they were glad to welcome to their deliberations that day Mr. Sturgess, the Head of the Veterinary Department. The first item on the agenda was the paper by Mr. R. M. Fernando, on " Dairy Farming and Breeding of Stock in the Kurunegala District." That was a subject in which he took a great deal of interest. In fact, he would endeavour to do something in the matter, which was a special hobby of his. There were difficulties in the way, but he thought that those difficulties existed in order to be surmounted. He understood that Mr. Fernando had been carrying on stock-breeding work on a very interesting and promising manner. He hoped before long to have an opportunity of seeing what had been done on his estates.

His Excellency then called upon Mr. R. M. Fernando to read his paper on " Dairy Farming and Breeding of Stock in the Kurunegala District."

Dairy Farming and Breeding of Stock in the Kurunegala District.

REGINALD M. FERNANDO, M.A. (Cantab).

THE need for pure milk at a reasonable price is a crying want in Ceylon. The solution of this problem is closely connected with the still more important problem of the high infant mortality especially in the Urban Centres. The root cause is now well understood. It is due to the fact that Ceylon cattle are utterly useless for milk production. The yield of milk in a Sinhalese cow is not even sufficient to rear its own calf successfully. The Indian Breeds although far in advance of Ceylon animals are very inferior in the yield of milk when compared with European standards. To give a concrete example, the average yield of a Scind herd per year does not amount to more than 200 gallons per cow. This is, I believe, about the average in the Government Dairy herd. In England a cow that yields less than 600 gallons or 6,000 lb. of milk a year is considered a profitless animal. Many Dairy herds in the British Isles are known to yield more than 10,000 lb. of milk per cow per annum. In these circumstances, there is nothing remarkable to find that milk is much cheaper in England and in Europe generally than in India or Ceylon, for the important reason that the Indian cow as an instrument of milk production is vastly inferior to the milk breeds of Europe. The latter have been evolved after generations of careful and selective breeding, whereas such methods of selective breeding have not been practised either in India or Ceylon till quite recently. To evolve a herd of cows which will give yields of milk that can compare with European yields is then the central problem which must be solved before we can expect a larger and a cheaper supply of milk in this country.

The vast strides the dairy industry has made in England in recent years, especially since the termination of the European War, is chiefly due to the encouragement given by the Board of Agriculture to milk-recording Societies. These Societies only recognize dairies which keep a strict record of the milk yields of all animals and carry on the breeding of dairy animals using only sires with high milk-yield pedigrees. As I have said before, a cow that yields under 6,000 lb. of milk a year is scrapped under this system of milk recording.

The improvement in the milk yield of cows may be attempted in Ceylon in more than one way. I have however worked on the principle of starting a herd of a number of cows obtained locally of the milk strains available, such as Scind and locally bred English and Australian cows to be mated to pedigree bulls of well known British dairy breeds. My early experiments were with Jersey and Ayrshire sires of good milk pedigrees obtained locally. This was during the war and immediately after the war, when the importation of English bulls was out of the question. The results obtained from the introduction of pure-bred Jersey and Ayrshire sires were very encouraging as far as the milk yields of the half-bred heifers were concerned. Since 1921, however, I have used only British Friesian Stud bulls of known pedigree, which I have imported from time to time. At present I have three such stud bulls on three different places in the Kurunegala District. The stock bred during the past seven years from these Friesian sires are thriving wonderfully and, as for hardiness, the Friesian half-breds and three-quarter breds are not behind the ordinary village cattle of the district. This is a great point in favour of the Friesian breed. Cross-bred Jersey and Ayrshire cattle are if anything rather delicate when reared in the low-country. The half-bred Friesian cows now in milk are much superior to their dams, not only in the yields they give but in the duration of the lactation period. I have not had the opportunity yet to test the milk yields of any of my three-quarter-bred Friesian heifers, as the oldest of the second generation heifers has yet to calve. I am confident that these will easily eclipse their dams as milkers. The success so far attained point clearly to the fact that in four or five generations, a grade of cows can be bred which approximate closely to the pure-bred Friesian. These results have been obtained by systematic grading of my milking herds, that is to say, all unthrifty, aged, and comparatively poor milking animals are weeded out annually.

Another problem that has to be faced in Ceylon when one goes in for cross-breeding is the utilisation of the bull calves so bred. Fattening for the butcher is out of the question, as the local price of beef will not leave the fattener or grazier with any margin of profit. I use the great majority of my cross-bred bulls for draught purposes and I find they make excellent cart bulls. They certainly draw a bigger load than the ordinary Sinhalese cart bull and I find they are just as hardy even in the low-country. It is in this respect that I found the cross-bred Jersey and Ayrshire bulls failed. They seem to feel the heat in the low-country while on the open road and the type of animal is not suited for drawing big loads, as invariably their backs are wedge-shaped and poor in muscle. The cross-bred Friesian bulls can be put to the cart at three years of age, whereas Indian bulls cannot be trained until they are at least four years old.

Professor K. W. Forman of the Allahabad Agricultural Institute writing on the subject of cross-breeding and grading of cattle in India gives detailed statistics to prove that Ayrshire sires have proved unsatisfactory in the cross-breeding experiments carried out on an extensive scale by the Military Dairies in India. "The main reason for the failure of the Ayrshire," he says, "is due to the fact that it has not the characters which will blend with the characters of the Indian breeds on which it has been tried in the making of a progeny which will have constitution as well as good milking qualities in the second and third generations." With reference to the cross-breeding experiments with the Friesian breed, he says that the breed has so far surpassed the Ayrshire breed. Comparing the results obtained from the mating of bulls of these two breeds with cows of Indian breeds, he states—"The $\frac{3}{4}$ Aryshire is very inferior to the half-bred Ayrshire and the $\frac{7}{8}$ Aryshire is a hopeless animal both from the point of breeding as well as a milk producer. The $\frac{3}{4}$ Friesian has proved to be a superior animal to the half-bred Friesian. Just how far the Friesian can be used for grading up purposes is not yet known. The $\frac{7}{8}$ Friesian-Rariana grades are proved to be animals of good constitution and good milkers." From the foregoing results obtained after years of cross-breeding with Friesian sires at the Lucknow Military Dairy, I have every reason to believe that my efforts in this direction with pedigree Friesian sires will in time to come produce a graded herd of milkers worth possessing.

The breeding of milk cattle is by no means a simple problem. The greatest difficulty in Ceylon is the need of men trained in animal husbandry and in dairy work. I had in the initial stages to train my own men, and in the process many blunders were committed. Amongst other local drawbacks I may mention the trouble with ticks, especially on estates. This has to be continuously grappled with. In all my cattle stations I use cattle dips regularly once in ten days.

Every dairyman knows that a semi-wild or nervous animal is not a good milker. When cattle are bred on estates and allowed to graze at large, nervous tendencies are bound to develop. The only way that this can be overcome is to bring every animal into a cattle shed at night, where stall feeding and handling can be resorted to. For cows in milk, stall feeding is absolutely essential.

This brings me to the subject of fodder crops. From my experience in the Kurunegala District, I have found that both Guinea grass and Napier grass grow very luxuriantly, especially on lands bordering on the Deduru Oya. Both these grasses make excellent cut fodder and where they can be grown, one

need not worry about a dearth of green fodder even in the severest drought. During rainy weather Guinea grass can be cut once a fortnight or three weeks. The yield per acre per annum exceeds forty tons of green fodder.

Some years ago, I attempted an experiment in the growing of Lucerne on two different places in the Kurunegala District with Indian seed. The growth of this excellent fodder crop was quite fair and after about two years' cropping, the cultivations were discontinued as the plots got overrun with dodder. Last December I tried this fodder crop again with Australian dodder-free seed on a $\frac{1}{4}$ acre plot at Migastenne Estate on the banks of the Deduru Oya. The seeds germinated quickly and exceedingly well and at seven weeks, the plot was ready for the first cut. I consider this patch of Lucerne the finest I have seen anywhere as far as growth is concerned. It is still rather early to come to any definite conclusions in regard to the possibilities of growing Lucerne in this district, but with the passage of time, if it proves the success it promises to be just now, the problem of milk production at a cheap rate can be solved almost at once. Lucerne will enable us to produce milk at half the present cost. With the feeding of Lucerne to milking stock, expensive oil cakes and miller's offals can be dispensed with to a very great extent.

In addition to breeding cattle for milk purposes, I have been experimenting with Jafferbadi buffalos since 1920. I have a pure-bred herd of these animals, as well as several cross-bred herds; the cross-breds being half and $\frac{3}{4}$ bred Jafferbadi-Ceylon buffalos. The Jafferbadi is a heavy milking breed as far as buffalos go, some standout milkers giving as much as 40 lb. of milk per day at the height of each lactation period. They are possessed of hardy constitutions and well suited for ploughing and transport on estates, besides being good milkers. The half-breds are decided improvements on the Ceylon breed both in size and milking qualities. The second generation grades are nearly the same as the pure Jafferbadi in appearance, and I expect very soon to be able to report a higher average milk yield with these $\frac{3}{4}$ breds as compared with the half-breds.

A few years ago I obtained through the help of Mr. Stockdale a small number of Jumna Pari goats from the United Provinces in India. These animals are reputed for quantity both in mutton and in milk and, being smooth coated, are well suited for the low-country. Unfortunately the original importation (10 in number) arrived in poor condition owing to the length of travel and bad weather from Calcutta and several deaths occurred. The remainder enabled me to establish a herd which is now doing well in the Hiriyala Hatpattu of the Kurunegala District.

Discussion.

His Excellency the Governor said that they were all indebted to Mr. Fernando for his interesting and stimulating paper, and he had no doubt that it would lead to an animated discussion. It was very desirable that those present should show their interest in the subject by offering their observations or asking any questions which might occur to them. He was sure that both Mr. Fernando and Mr. Sturgess would do their best to answer any questions.

Mr. A. Bowie said that the paper read by Mr. Fernando was a comprehensive one, in which the whole subject had been fully covered. There were one or two matters that he would like to mention. The great trouble in Ceylon was that the people who purchased good animals did not feed the calves. They took all the milk possible and starved the calves. That was a very important matter. It was his opinion that if they fed their calves properly the different breeds in the country would soon improve. For the past thirty years, the speaker had imported cattle and during recent years Mr. Stockdale had tried to get assistance from Government in regard to freights. It was a very expensive matter importing valuable cattle, and he had not been able to get any help from Government. He imported cattle solely for the purpose of the improvement of cattle in the Island. There was absolutely no profit from a cattle establishment. The whole profit was keeping a manurial establishment for tea but everybody did not approve of that altogether.

His Excellency asked Mr. Bowie whether the chief item that made the cost of the importation of cattle prohibitive was that of freight.

Mr. Bowie replied that freight charges were heavy, while the actual cost of good cattle was also a very heavy item. They could not get a good animal for less than £150 or £180. Freight, of course, was a very heavy item, but he could not say exactly what the exact charges were now as he had not imported cattle for the past few years.

Mr. Fernando said that freight charges were £48 for the first animal and £34 for the second.

His Excellency asked whether there was no reduction if they imported large stocks.

Mr. Fernando replied in the negative.

Mr. Stockdale stated that the whole question of freight was under consideration and the question of granting some subsidy for the importation of pure breed stocks was also being considered. In that connection, he had a letter received from Mr. A. J. Hamilton Harding in which he raised the same question.

It was his (Mr. Hamilton Harding's) opinion that increase of the milk supply of the Island was very important for hospitals and nursing homes and it was the duty of Government to assist private purchasers, so that the stock of the country could be improved. That might be a big question, but if it were cautiously approached and a practical scheme put forward there was no reason why it should not be a success.

He (the speaker) was greatly interested in Mr. Fernando's paper. He had an opportunity of seeing the crossing of Indian and European stock in the West Indies and in India. In the West Indies the crossing of Friesians with Indian breeds had not been a great success and in consequence of this experience, he was inclined to grow the crossing of Indian breeds with the Ayrshire. But the stock which Mr. Fernando had got with Friesians were certainly excellent, and indicated that the breed was a suitable one for crossing in the Tropics with Indian cattle. The case that Mr. Fernando quoted

from Allahabad also supported that view and Mr. Bowie in recent years had considerable experience with Friesians and so far his experience had been entirly satisfactory. These animals throve well in Ceylon and anyone who had seen Mr. Fernando's cross breeds could not but be convinced of the possibilities of that breed for crossing with Indian cattle. They were heavy milk yielders and cross-bred animals between Indian and European breeds gave in the first generation an increase of at least 50 per cent. in milk yield. Mr. Sturgess had had experience of crossing in the Government Dairy in Colombo and he (the speaker) thought that he would support that figure quoted by him.

Mr. Sturgess.—Of course, Mr. Fernando speaks from the point of view of the landowner, and I am quite sure it is to those gentlemen who own lands and estates that we have to look for a good deal of support and interest in improving stock. I quite agree with all that Mr. Fernando said, but what I think about stock improvement is that it must go hand in hand with estate work. Of course, I have not seen any Balance Sheet, but if high priced animals such as were alluded to by Mr. Bowie are used, the cost of the improvement to an ordinary man is prohibitive. We have to devise some scheme by which men of a lower state of wealth can improve their cattle, and large estate-owners must give their wealth and interest to the people who are lower down the scale of wealth, particularly the dairymen.

Regarding the milk found in this country, Mr. Sturgess said that the quantity of milk was very poor in this country and a good deal of that was due to the fact that they had to purchase all their artificial food from outside. Nothing except coconut poonac and grass is produced in Ceylon. Much of the stock deficiency and deficiency in milk was due to the want of proper feeding. The cattle did not get any opportunity of developing, they were mostly underfed.

On the point of crossing European and Indian breeds referred to by the Director of Agriculture, he supported the view that there would be 50 per cent. improvement in milk yields. They had imported a pair of Ayrshire bulls and crossed with Scinds. The progeny were coming into milk and they were at present giving 32 pints a day. This was quite satisfactory from the milking point of view, but that was work which could not be carried on by ordinary people. He thought it would be cheaper for landed proprietors, if they could devise a scheme to work the estate and develop live stock at the same time so as to get manure for the land, but it could not be done in a haphazard way. They wanted a few more gentlemen like Mr. Fernando to take a more personal interest in stock breeding.

Mr. H. L. De Mel.—As a lover of cattle and one engaged in breeding cattle for a number of years I should like to offer my congratulations to Mr. Fernando for the success he has achieved with this type of cattle breeding and I feel sure that his experiments will be carried on for years to come with the same enthusiasm.

Continuing Mr. De Mel said that he wished to ask one or two questions from Mr. Fernando. Referring to the statement of Mr. Fernando that he found fodder crops growing on river banks and of Mr. Sturgess that they looked to estate-owners to increase breeds, he (the speaker) said that he had considerable experience in keeping cattle on estates largely for manurial purposes and more recently for improving cattle and improving the outlook in the district around. They could not accept the policy of Mr. Fernando of importing cattle and improving the breed merely for milking purposes. What the average owner would like was the improvement of his type of cattle and also to be taught the importance of feeding his cattle in his own establishment. Having this in view some years ago he started upon a cattle breeding farm largely with the object of demonstrating to his less fortunate brethren the advantages

of stall feeding. Ordinary fodder grass in this country lacked lime and phosphates. Young cattle could not thrive with the result that they had to be fed with bone-meal. Mr. Sturgess had advised him to introduce lime into the drinking water of young stock.

He (the speaker) endorsed the statement of Mr. Fernando with regard to the difficulty of getting men who could handle cattle. He was prepared to offer anything, he said, to young men who would offer to look after cattle for the sake of looking after cattle.

He wished to know Mr. Fernando's experience of pasture feeding and lack of bone in young cattle and with regard to keeping cattle for manurial purposes.

Mr. Fernando, whilst agreeing that lime water did help the calf along, thought that the difficulty could best be overcome by putting calcium into its milk. He found that systematic slagging of pastures and grass lands led to the improvement of young cattle. As for breeding cattle for manurial purposes, the practice of the villager of allowing his cattle to graze as they went on without attention would not bring him any manure at all. With regard to Mr. Sturgess' remark that proprietary planters who went in for cattle breed stock should help the milkman, he said that he did not agree with it unless the milkman gave a guarantee that the animal given to him would be looked after. The town milkman generally got the most milk possible out of the cow, starved the calf and then sent the cows away at the end of the lactation period.

Mr. W. A. de Silva said that all sides of the question should be considered. Dairy farming to be carried in accordance with modern accepted principles would require a considerable amount of capital, intelligence and experience and only a very few could be expected to embark on it. But there was the very wide question of improving the cattle belonging to the peasantry. That also should receive some attention and it could not be carried out on the lines adopted in capitalist dairy farming. He had some experience of that matter perhaps extending over a long period having been in charge of the Government Dairy Farm before Mr. Sturgess, and also he had been in India and selected the batch of Scind cattle for the Government Dairy Farm. His own opinion as to the improvement of village cattle was that they would never succeed unless they began from the stage they were at present. It was mentioned that cattle were allowed to roam about and eke out their own existence. There was another aspect to this, namely the villagers' use of cattle, and buffalos for paddy cultivation. The villager had to keep a certain number for the purpose.

Those animals might not be milk breeds but yet they had some use. These animals got a certain amount of food roaming about the roadsides. Perhaps the owner of the cattle got even less. Even in our estimation of cruelty we must save some consideration for the man; if he was himself starving, he could not be expected to do better for his animals than he did. He brought that because when they spoke of the establishment of big Dairy Farms they were liable to overlook the most important point. There may be great possibilities of improvement if communal land for grazing purposes were available. In the olden days buffalos were used for milking purposes but gradually the breed of buffalos had deteriorated and thereby another problem had arisen. Mr. Fernando's experiments were very interesting and were bringing before those who were able to spend the money and the time the possibility of an industry which would help the country a great deal.

Mr. Stockdale.—I entirely agree with Mr. de Silva in what he said in that we must now overlook the villagers' cattle in our consideration of this question, and this matter was considered last year in the Estimates and

Mr. Sturgess and myself have been charged by Government to draw out proposals for dealing with the stock question comprehensively. In the proposals that we have drawn up we made certain suggestions for encouraging the very form of cattle breeding that has been discussed among estate owners, but at the same time we have also included proposals—fairly far-reaching—for the improvement of village cattle and our suggestion is that we should not look for European stock or imported Indian stock for the improvement, but make a selection of the best Sinhalese cattle and use them for the improvement of village cattle. I think the proposals that have been evolved are worthy of consideration and I think if they are adopted, the improvement of stock both on estates and dairies and villages can easily go hand in hand. There is just one other point I should like to ask Mr. Fernando. I think his experience with lucerne which he has advocated is limited. I shall be glad if he can give any further information on that point. We have had lucerne at Peradeniya on several occasions but it has not been successful. We get the first cuttings very satisfactorily, and probably the second cuttings are good, and then it seems to die out. That is the experience elsewhere under tropical conditions. It seems that the heavy rainfall is detrimental to the growth of lucerne after it has been cut. Admittedly lucerne was one of the best fodders and if it could be established here it would prove most beneficial.

Mr. Fernando said that his experience of lucerne was the same as Mr. Stockdale's. He was going into the subject and had obtained quotations for a variety of drought-resisting lucerne, but as a quantity of seed was not available, roots had to be sent to him.

Mr. J. P. Obeyesekere asked if it would not be more paying to breed buffalos instead of expensive cattle like Friesians. Buffalos were very good for draught purposes except that they were slow and now-a-days slow moving cattle were preferable. Besides they were inexpensive and buffalos imported from India were good milkers.

Mr. Fernando said that his experience was that it cost about one-third in the case of buffalos. Certainly it was an excellent thing to breed buffalos for draught purposes and milk. His idea in breeding Friesians was to concentrate on milk production.

Mr. Obeyesekere pointed out that buffalos were indigenous to the country, suited to the country and that it was easier to introduce a good strain of buffalo.

Mr. Fernando said that it was the roaming about the country that had deteriorated the present buffalo. The introduction of buffalos would mean stall feeding and that was where the villager kicked.

Mr. de Silva enquired whether there was any medium by which instruction in animal husbandry was imparted.

Mr. Stockdale said that at all the agricultural schools dairying was a subject of instruction. There was a dairy at Peradeniya and one at Jaffna Farm Schools and provision was being made in the two new schools at Galle and the North-Western Province for draught and dairy herds.

Mr. de Silva next asked whether some means could not be found of disseminating the information gathered at places like that Conference. He suggested the formation of farmers' clubs.

His Excellency said that Mr. de Silva's suggestion was a very useful one. He wondered whether it would not be helpful to start a number of cattle shows and give prizes not only for the best animals but also for animals in the best condition incidentally giving encouragement to kindly treatment of animals. Instead of money prizes, certificates might be given. He was inclined to think, considering the psychology of the people, it would serve as

an encouragement and also as a stimulus. He mentioned the conditions prevailing in Northern Rhodesia where wealth was determined in terms of heads of cattle and the animals were largely used as payment for a wife for which the quality of the cattle did not matter. Before he left that country, His Excellency added, he laid the foundation of an experiment by which a number of good breed of bulls were leased to villagers for their use on a nominal charge or free on condition that they undertook to look after the progeny Possibly something of the same kind could be tried here. One of the difficulties, no doubt, was the prevalence of bulls of poor quality which had to be neutralized. Whether that was practicable in Ceylon he did not know. It was a problem for experts to take into consideration. He agreed with Mr. de Silva that there should be improvement not only at the top but also of the villagers' animals. He believed, as Mr. Stockdale said, that the two processes must go hand in hand. He wished to have the opinion of people who knew the country better whether the establishment of shows would be useful.

Mr. A. Godamune said that to his mind the problem fell into three divisions—the improvement of stock, the increasing of stock and feeding of stock. The feeding of stock and improvement of stock had been discussed, but as regards increase, the position had not been appreciated. The use of ordinary bulls for ploughing instead of buffalos showed the decrease of buffalos. What struck him was that those who were trying to work for the villager had not looked at the problem from the point of view of the villager.

Mr. C. V. Brayne said that the really big problem they had to tackle was whether they could not do anything for the improvement of village cattle. The real point of the problem appeared to be the attitude of the mind of the villager in regard to his cattle. He had experience in several parts of the country especially in the sparsely populated parts of the Island, and it seemed to him that the interest of the villager was strictly limited. He was quite satisfied if he got some manure for his garden, a little ploughing done, and occasionally a little milk. Beyond that he had no interest at all. If you told him that he must feed his cattle better, he would reply " What do I gain by that ? " The first thing that the villager should be convinced of was that it was in his own interests worth while treating his cattle better. His experience was that the ordinary villager cared more for his cart-bull and left the cow alone. It seemed to him that for some time they should tackle that problem from the market end and organize the sale of milk. That will give the villager a definite interest. In some parts of the country there was no sale of milk at all. If there was a definite demand for milk and a definite market, he was sure that things would improve. In that way, interest would be stimulated.

Mudaliyar Ramalingam spoke of the difficulties of the Jaffna man in regard to cattle and fodder and the several attempts made to improve stock in the North. The Director of Agriculture and the successive Government Agents did their best, he said, for the Jaffna man and the cattle at Tinnevelly were doing well.

Mr. Muttiah wished to know whether lucerne could be successfully grown in Batticaloa. The Batticaloa people had not seen what lucerne was and whether it could be grown profitably there was a thing that should be ascertained.

Mr. Stockdale.—With regard to the question asked by Mr. Muttiah, I may say that no experiments have been made with lucerne in Batticaloa. The only experiment they had made in the drier areas was in the Northern Province. With regard to Batticaloa, Government had under consideration the question of opening in the Eastern Province as soon as trained men were

available, an agricultural school and farm, and then we shall establish dairy herds at that farm, and naturally carry on experiments such as those advocated by Mr. Muttiah.

Continuing, Mr. Stockdale said that with regard to what Mudaliyar Ramalingam had said regarding Jaffna, the question of fodder was not an easy one in the dry North. He suggested that the Jaffna people should look to India (Madras) and adopt a system of growing fodder for cattle. He agreed it was uneconomical to expect cattle of the North to thrive on the dust of the roads which was about all they could get at certain times of the year.

Mr. Brayne asked whether if a dairy farm was established in the Eastern Province, the system he suggested—that of buying milk from the surrounding district—could be tried.

Mr. Stockdale said that co-operative dairying was under consideration. It was a difficult question and first of all, the attempts would have to be near towns. There must be an assurance of a certain demand for the milk.

His Excellency suggested that a creamery would be useful. Of course, undoubtedly, the universal experience was that it paid better to sell milk in the form of milk than butter.

Mr. Brayne.—I may be wrong; the local milk is absolutely richer than milk in temperate countries. The quantity is small but the quality is richer. I should like to be corrected.

Mr. W. A. de Silva said that 17 bottles went to make a pound of butter and 11 bottles of buffalo milk.

Mr. Bowie remarked that 8 to 10 bottles of the milk of Friesians went to make a pound of butter.

Mr. De Mel mentioned that Mudaliyar Rajapakse and his brother had supplied Negombo villagers with cattle and he himself had sold about 120. The suggestion of His Excellency in regard to Shows might be followed and prizes offered for the best kept cattle.

Continuing Mr. De Mel referred to the number of buffalos run over by trains and said that if the owners had paid greater attention on their buffalos, that number would have been available for agricultural purposes.

Mr. Stockdale.—Mr. De Mel has referred in his remarks to the value of cattle establishments in estates for manuring purposes, and before we close this discussion, I should just like to read some notes which have been sent to me by Mr. E. W. Keith, the Superintendent of Kondasale Estate:—

"A fairly large cattle establishment has been maintained on Kondasale Estate for many years.

The primary object of this establishment was and still is for purposes of obtaining manure.

The breed of animal up to about 1919 was a cross of the Indian breeds, more or less common in Ceylon, viz., Nellor, Scind, etc.

This breed was evidently chosen as being the most suitable for the climate and general conditions. Other breeds, such as Australian and English, have occasionally been tried but without much success.

The climate is evidently unsuitable for Australian and English animals, a most noticeable feature being the large percentage of cows that become "barren" after the first or second calf.

The bulls obviously feel the climate and cannot be considered good for draught purposes.

Through continual inter-breeding, the size and quality of the animals were showing signs of deterioration and in 1919 we discussed the possibility of improving the stock with the Director of Agriculture and acting on his advice imported 3 heifers and 2 bulls from the Government Military farm at Hissar. We are indeed glad that we acted upon his advice as our stock has now improved beyond recognition.

The Hissar I would say is easily the largest of all the Indian breeds—about the same height as the Nellor but is a thicker and a much heavier animal. For draught purposes I consider these animals are the finest in Ceylon and capable of pulling heavier loads than any other.

I would not consider this a good breed for dairy purposes. The average quantity of milk obtained is not more than from 6 to 8 bottles per day. I have no doubt this can be increased by more careful attention being paid to the food supplied.

The Hissar is a hardy animal and is seldom sick or sorry.

As regards cattle disease we have been rather fortunate, an occasional outbreak of foot-and-mouth disease is all that we have had to contend with. As soon as it is known that there is any disease in the neighbourhood, every precaution is taken to prevent it spreading to the estate by closing all roads, limiting cart transport to within the estate bounds and systematically disinfecting the sheds.

Since the arrival of these Hissar animals in Ceylon in December, 1919, we have bred from this stock a total of 167 animals, i.e., 34 pure breds and 133 cross breds.

The cross breds were obtained from the old Nellore-Scind cows and Hissar bulls and are a great improvement on the old stock.

The number of animals on the estate are as follows :—

Year		Estate Owned	Average Borrowed	Total
1915-1919	...	140	144	284
1920-1925	...	177	104	284
1926-1928	...	200	74	274

I previously mentioned the cattle here were kept mainly for the manure and expensive feeding is therefore unnecessary.

Coconut cake, grass and paddy straw is all that are supplied.

The average quantity of food supplied to a full grown animal is 10 to 15 bundles of grass or straw and from 8 to 10 lb. of poonac a day.

The cost per head inclusive of labour, cultivation of grass fields and purchase of straw when necessary, has varied from Rs. 6·31 per head per month in 1915-1919 up to Rs. 10·78 in 1926-1928.

The increased cost may be attributed to the higher price of everything since the war and also to the better class of animals requiring more food to keep them in good condition.

The acreage under grass to feed these animals is 119 acres planted in Guinea, Mauritius and Napier grasses and 53 acres of grazing ground.

The 119 acres is regularly cultivated, and we find, to get the maximum quantity of grass from this area, it is necessary to replant after five to seven years.

The quantity of grass supplied from this area is sufficient except in periods of drought when straw has to be purchased. For the period 1925-1927 it was necessary to purchase 48,000 bundles of straw or say 14 tons a year.

The question now arises as to whether a cattle establishment of this description is a profitable concern or otherwise.

If we take into consideration the quantity and value of manure supplied by the establishment, there is no doubt that it is a profitable concern.

The quantity of manure was not actually weighed, but in the season 1925-27, we manured 490 acres of cacao in the three years. Allowing approximately 40 lb. per tree and 300 trees to the acre, it amounts to 12,000 lb. or say five tons—so that in the three years we secured approximately 2,450 tons or 800 tons per annum. It is difficult to fix the value of this manure per ton. Taking it at Rs. 20, which, from the results obtained, I do not consider is too high, the establishment would show a profit of between Rs. 3,000 to Rs. 4,000 a year.

As I have previously stated, the Cattle Establishment has been on this estate for many years and pen manure has been regularly applied with the result that an average crop of cacao amounting to 6 cwt. per acre has been secured for the past 20 years, which over a large acreage constitutes a record not only for Ceylon but for the world."

His Excellency in winding up the discussion said that they had a very interesting discussion. They were very much obliged to Mr. Fernando for having initiated and to the other gentlemen who threw additional light on the subject. He hoped that the matter would not be allowed to lie at that stage but that those who took part in the discussion and those who read it in the papers would take a practical interest in the problem.

His Excellency then requested Mr. L. Lord to read his paper entitled "Some of the limiting factors in the improvement of paddy cultivation in Ceylon."

Some of the Limiting Factors in the Improvement of Paddy Cultivation in Ceylon.

L. LORD, M.A.,

Economic Botanist, Department of Agriculture.

IT would have been more cumbersome, but more precise, to have added to the title of this paper "and an account of some of the factors which hinder paddy cultivation in Ceylon from being more profitable to the cultivator" but I am sure you will agree that methods of increasing the net returns of the cultivator form an essential part of the improvement of paddy cultivation.

Many people view with concern the fact that Ceylon produces annually about 13 million bushels of paddy whereas it imports, either in the form of paddy or rice over 31 million bushels, or more than twice the production. While the use of better seed and methods of cultivation, etc., will appreciably raise the production it is being too optimistic to hope that their use on the existing cultivable paddy land will result in a production of paddy equal to the consumption. More land will have to be rendered

cultivable (by means, e.g., of new, large irrigation schemes or by the improvement of minor schemes) to effect this, but I have not seen estimates of what is possible by these means.

This paper deals with factors which limit the economic improvement of cultivation on existing paddy land. I have added the word 'economic' here because it is, of course, possible to obtain by heavy dressings of manure, outturns which will not cover expenses, and it is possible also to increase outturns by an intensive system of cultivation which may lower the standard of living. And that is why, I think, we must consider in discussing possible improvements, first and always, the cultivator himself.

Last year it was my privilege to describe to this Conference some of the ways in which paddy cultivation could be improved. This year I wish to draw attention to the factors which either hinder or prevent such improvement.

Improvements and limiting factors may conveniently be classed as follows:—

Improvements:

1. Seed and seed supply
2. Cultural methods
3. Increase in size of holdings

Limiting Factors:

1. Pests and diseases
2. Credit facilities
3. Marketing
4. Climate and labour
5. Restricted area of cultivable paddy land
6. Conditions of tenancy

It is neither desirable nor possible to confine discussion of the above improvements and limiting factors to the, perhaps arbitrary, classes which have been specified. For each class of improvement there is no one single limiting factor, there is a combination of limiting factors of varying degrees of importance and the same factor may limit the adoption of two or three improvements. In dealing with the size of holdings it is convenient to include the restricted area of paddy land available instead of discussing this limiting factor separately.

Seed and seed supply.—The improvement of paddy cultivation by the use of selected seed is well known. From the cultivators' point of view it is a simple method as it entails no extra work and generally little or no extra expense. The factors which limit the improvement by this means are the impossibility so far as pure-line selection is concerned of selecting out of a mixed population anything better than the best strain already there, and

the difficulty of conducting yield trials accurately enough to discover the best strain. In course of time hybridisation may open the way to obtaining higher yielding strains still but at present increases of yield by the use of selected seed of more than 20% cannot be expected. It must be remembered too that when an equilibrium is established between the plant food naturally rendered available for each crop, and the plant food utilised by the crop more cannot be taken out of the land without suitable manuring. The factors which limit the supply of seed—finance, staff and organization—are to a certain extent controllable and it is not intended to deal with these here.

Cultural Methods.—The more obvious improvements in cultural methods are better preliminary cultivation, thorough weeding, the substitution of transplanting for broadcasting and, lastly, manuring. Better preliminary cultivation can be obtained by the use of ploughs and harrows which entail the use of cattle. To obtain implements and cattle money is necessary and the limiting factors are chiefly the difficulty of obtaining credit or of obtaining it on reasonable terms, and partly, in some places, the difficulty of obtaining fodder for the cattle.

Weeding has been shown to increase yields appreciably. A 36% increase has been obtained at Anuradhapura. A conservative estimate of the increase to be obtained generally is from 20-25%. The cost of weeding will vary with the amount of household labour used but if paid for in cash it should be less than Rs. 12 per acre. The increase of yield should not be less than from five to six bushels which @ Rs. 2·50 per bushel amounts to Rs. 12·50 to Rs. 15·00 per acre.

If therefore, the cultivator received for his own use all the increase, weeding is profitable and may be very profitable but where, as so often happens in Ceylon, a cultivator is a tenant on half shares, half the increase goes to the landlord (who has done nothing to merit the increased return) and the cultivator cannot be blamed for preferring to spend his time working on estates, roads, etc., where he obtains the full value of his labour. The conditions of land tenancy prevailing in many parts of Ceylon constitute the chief factor in limiting improvement by this method.

There is no doubt that transplanting increases the yield of paddy. At Anuradhapura, with six month paddies, transplanting has resulted in a 30% increase. The experiment has been fully described in the *Tropical Agriculturist* for July, 1927. The value of the increase will under ordinary circumstances more than cover the extra cost of transplanting. Normally the increased return should be more than double the cost.

Two factors limit the adoption of transplanting, first, uncertainty of water at transplanting time and secondly under a share system of tenancy the fact that half of the increase would go into the pockets of the landlord. Where paddy depends for its water supply on direct rainfall it may be dangerous not to take the opportunity during the earlier rains of broadcasting the fields.

We have in Ceylon at present little scientific evidence as to the value of the increased returns given by the application of manures but most cultivators realise the value of cattle dung, green leaves and steamed bone meal. Experiments have been started to collect reliable data, but there will be little incentive for the cultivator on half shares to buy and apply manures when half the increase of yield due to their use goes to the landlord.

So far as the adoption of improved methods is concerned it will be seen that the limiting factors are chiefly tenancy conditions and the difficulty of obtaining cheap credit and partly, in certain districts, the uncertainty of the water supply. A limiting factor which I think can be removed in course of time is the conservatism of the cultivator himself.

Size of Holdings.—Statistics of the size of paddy holdings *worked* by a single occupier in the different parts of Ceylon have not been obtainable but there is no doubt that the average holding is exceedingly small. The following are rough estimates:—Peradeniya and neighbourhood 1-2 acres, Jaffna 1-1½ acres, Batticaloa 25 acres worked by four occupiers co-operatively, Tissamaharama 3-4 acres, Weligama 1½-2½ acres, Anuradhapura 3 acres. It is doubtful if the average paddy holding in Ceylon worked by an occupier is much more than from 2-3 acres. The size compares, perhaps, favourably with holdings in Japan. Keatinge* talks of the "2-acre holding of the Japanese peasant who wields his hoe from morning to night and treats each plant in his field to a separate dose of liquid manure" but who, according to Darling† "keep themselves afloat by the rearing of silk worms." I think this picture of Japanese cultivators implies a standard of living lower than what we hope for in Ceylon.

If we turn to Burma we find conditions very different. In Lower Burma the average holding worked by a single occupier varies from 20-40 acres. In Upper Burma I believe it is about 7 acres.

A 2-3 acre holding cultivated under Ceylon conditions is not an economic holding but so long as the Ceylonese holds as he does the view that cultivating paddy land—even as a tenant—is a higher form of work than cooly work, that it gives a certain

* Keatinge, G. Agricultural Progress in Western India.

† Darling, M.L. The Punjab Peasant in Prosperity and Debt.

amount of social prestige, so long will these conditions remain. The demand for paddy holdings in certain districts is so great that landlords are offered a monetary inducement over and above the ordinary terms of tenancy to favour a particular applicant. In the Ratnapura district the landlord himself levies a *madaran** or tax, which varies according to the fertility of the fields, besides taking his half share. There is, of course, in Ceylon, land still available for paddy cultivation and it may be possible by the provision of new irrigation schemes or the repair of old ones to bring more land under cultivation. Where paddy land is available at present, e.g., in the Northern Province, factors such as the prevalence of malaria and the lack of cheap capital retard its being taken into cultivation.

Pests and Diseases.—The paddy crop suffers from numerous pests and diseases which assist in reducing outturns. The following may be mentioned—birds, paddy flies, stem-borers, the fungus disease *Sclerotium oryzae*, land crabs and ravages of cattle and wild animals; and attack on stored paddy by moth and weevil. The provision of adequate fencing will lessen or prevent damage by wild animals; the damage, which is not very serious, by land crabs, can be prevented by trapping the crabs; and control measures against certain of the insect pests are possible.

Credit Facilities.—These have already been mentioned and it is only necessary to add that the spread of the co-operative movement offers great hope of ameliorating the present conditions of credit.

Marketing.—At the present time, so far as Ceylon is concerned the marketing problem is a minor one. With an increase in production it may assume great importance at which time co-operation will have another problem to tackle.

Climate and Labour.—Climate is used here in its widest meaning. As a limiting factor it acts in two ways, on the one hand it affects the area of the crop sown owing to good or poor rains (and the incidence of the rainfall may prevent the adoption of transplanting), and on the other it affects the condition of the cultivator himself. So far as rainfall is concerned we all know how disastrous the last season has been in the Northern and North-Central Provinces.

In certain districts the climate lowers the efficiency of the cultivator. Calvert† speaking of the Punjab says "In this country people will accept a low standard of living with small exertions rather than strive after a higher standard by greater

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* *See* Madanayake, A.—Conditions of tenancy in paddy cultivation in Ratnapura District.—*Trop. Agric.* LXVIII. 3., 1927., pp. 154-155.

† Calvert, H.—Wealth and Welfare of the Punjab.

exertions." This criticism might be applied to certain paddy cultivators in Ceylon, but where it is applicable I believe the energy of the cultivator has been sapped by repeated attacks of malaria.

In some districts there is apparently a shortage of labour for such operations as weeding and transplanting, but where the women of the villages are trained to do this work as they are, for example, in Burma, and in parts of the Central Province in Ceylon, there should be no real difficulty.

Conditions of Tenancy.—There are two essentially distinct forms of tenancy in Ceylon, the fixed rent and the share system. The share system predominates, and the lanlord's share of the net produce (the produce remaining after deductions for seed paddy, irrigation tax, fee to *Vel Vidane*, threshing charges, etc., have been made from the gross outturn) varies from a quarter (in newly opened areas) to two-thirds. Generally the landlord's share is one-half. Fixed rents are found in Jaffna and Batticaloa. In Jaffna the tenant pays in kind, 1 bushel per *lacham* or 24 bushels per acre, (which is almost double the rent in Lower Burma). In Batticaloa four tenants co-operatively cultivate 25 acres and reserve the produce of $2\frac{1}{2}$ acres out of the 25 for the landlord. They also do certain other work for the landlord. Though there are apparently fixed rents prevailing at Tissamaharama it is only the chief tenant who pays them (Rs. 5·00 to Rs. 6·00 per acre). The sub-tenant who does the work rents on half shares, and I am told that only cultivators who will borrow seed paddy and rice for consumption from the chief tenant (at an appropriate rate of interest) are given the opportunity of sub-renting the land. The share system is not confined entirely to the landlord. To a lesser extent certain cultivation charges are paid for by shares of the gross outturn, e.g., irrigation tax (1/10), threshing (1/16 to 1/20), *Vel Vidane* (1/48). The amount of the share charged for the above varies and the figures are given only as examples. It will be seen that where tenants cultivate on the share system they have very little incentive to produce larger outturns if any expenditure of money or labour is necessary because even half the increased yield is not secured to them. Why, for example, weed, when the six bushels increased yield (which is sufficient to show a profit) is cut down to three bushels (which is insufficient)?

It may be held that the share system of tenancy has the advantage that in a poor season, involving a partial or total failure of the crop the tenant has no burden of a fixed rent to bear. That is true, but in the event of a total failure involving a whole district it is always possible to follow the system which prevails in Jaffna. There, when there is a widespread total failure, no rents are charged.

In the brief space of time which has been allotted for this address it has been impossible to do more than indicate some of the limiting factors in the improvement of paddy cultivation, and any suggestions that have been made for eliminating these factors are even more faintly outlined. So far as tenancy conditions are concerned I hope the discussion, which, according to the programme, is to follow this paper, will bring to light practical methods of ameliorating these conditions. Fixed rents, security of tenure and compensation for tenants' improvements are possible lines of development.

Discussion.

His Excellency the Governor.—We have just listened to a very interesting paper which raises a question of great importance and great significance to the whole of the paddy growing industry. We should be very much interested to hear either landlords or cultivators, if they are present here.

The Hon. Mr. W. A. de Silva said that having written a great deal about paddy cultivation, he had thought he would put into practice what he had written and started growing paddy at Anuradhapura. Mr. Lord's paper was very interesting to them because he brought to bear on it his experience of another country where paddy cultivation was carried on on a large scale. He (Mr. Lord) was fresh to Ceylon and therefore, he could view things without prejudice. He was glad to find that Mr. Lord had not emphasised his own part or put forward proposals to revolutionise paddy cultivation for the people expected of the Department of Agriculture when a few hints were given that the yield would be increased by a hundred per cent. That expectation they should take care not to emphasise because they would never be able to get the real meaning of work done by the Department of Agriculture. They in Ceylon were fortunate in that they had a variety of soil and climate and it should be emphasized that the Island would be eminently suitable for a Central Research Station in regard to tropical agriculture. In regard to paddy, the same kind of paddy varied when planted in different places. Paddy that took 6 months to bear in the Kurunegala District when planted in the Anuradhapura District took 5 months to bear, etc. Those variations showed that in the various parts of the Island there were certain conditions in regard to soil and climate and other aspects which made the Island suitable as a centre for research in tropical agriculture. He hoped the Director of Agriculture would press that point as much as possible when the Central Agricultural Research Station was going to be established in connection with tropical products.

With regard to the paper itself, he said that it had to be borne in mind that in paddy cultivation, unlike in tea and rubber, it could only be carried on during a part of the year necessitating the cultivation of other land during the rest of the time. Old books showed that whenever there was paddy land there was a certain extent of high land attached to it. There was a dispute as to the exact area of high land. It was absolutely necessary in order to make paddy cultivation an economic proposition that the cultivator should have high land too.

Then in regard to the relations between landlord and tenant, Mr. De Silva said that in his experience so long as the landlord treated his tenant liberally he himself stood to benefit. A system he had found of very great value was where the tenancy was on half shares to see that the cultivator received half the gross produce and not half the nett produce. There should be no deduction for draught animals, manure or seed paddy which should all be supplied

by the landlord. He started work eight or 9 years ago and had a lot of statistics and he would submit the paper some day to the Director of Agriculture. With regard to the cultivators in the North-Central Province, a man or family worked on paddy for only six months. Work had to be found for the rest of the year. From actual figures he found that the cultivator obtained 120 bushels of paddy a year which might be put at Rs. 2·00 a bushel. If things could be arranged that way paddy cultivation need not be called unprofitable. As regards the conservatism of the cultivator, so far as his knowledge went, Mr. De Silva said, he considered conservatism a great asset because scientifically they had not found the causes for certain things and if they adopted measures which had been successful in other countries they were bound to make mistakes. As regards manuring, a mistake may be made because there must be something peculiar in the semi-liquid state of the earth which made the paddy plant thrive in it rather than in dry earth. In olden times there was not only " mud paddy " to translate the Sinhalese term literally but there was extensive cultivation of "elvi" or dry paddy. Then mud paddy was looked upon as second class and dry paddy was preferred.

Continuing Mr. De Silva stated that he could show that dry land cultivation in some parts of the North-Central Province was more profitable than the cultivation of irrigable land. The chena system had got itself established on account of a vicious principle of the desire for land on the part of the peasant, the official and the landlord. Instead of giving chenas with reluctance at the last moment if the cultivator was given a certain acreage and told that was his dry land, the man would be able to make a good living out of the land. Investigation and research should be carried out and care should be taken not to consider the paddy cultivator too conservative. He should be helped on his own lines by the supply of selected seed because it was a difficult thing for the cultivator to get good seed.

Mr. J. C. Ratwatte said that admittedly from a business standpoint, paddy cultivation was not paying and in order to make it so, the capitalist had to be attracted, for then machinery would come in and cultivation would be made cheaper. He thought the only thing to be done was to attract the capitalist and raise the tax on imported rice. From Mr. Lord's paper, it looked that the paddy land-owner must run his paddy land as a charitable institution. He must get a return for his investment. In theory the landlord seemed to get half the share but in practice the landlord—the absentee landlord—got one-third. It varied with the established customs which cultivators observed very rigidly. If paddy could be sold at Rs. 3·00 a bushel the industry could be self-supporting. Another important point was that seed stores should be established in every village and town. If pure-line paddy was used for seed and those who opened land encouraged its use, half the difficulty would be solved. Although the villager was conservative he knew his job, and would adopt improvements when they were demonstrated to him.

Mr. Geo. E. de Silva asked what percentage of profit a paddy cultivator could get per acre.

Mr. Lord said that it was almost impossible to reckon this as it depended on how much labour a cultivator received in co-operation for which he did not pay.

Mr. Geo. E. de Silva said that it was almost impossible for cultivators to make a profit while paying as much as 12 per cent. interest on money lent by Co-operative Societies. He suggested that the interest should not be so high as that.

Mr. A. Godamune thought that the subject was so vital that several days would be necessary to discuss it. Having listened to Mr. Lord's paper, it struck him that they were working high above the heads of the people directly concerned in it. No doubt, theoretically and scientifically if the proposals

put forward were given effect to they would bring some relief but he felt that they were so far away from the villager, so technical and so much above the average practical man that they should devote more time for the study of the subject from the point of view of the villager and so get at the heart of the problem.

Then with regard to the question of tenancy, he (the speaker) thought that Mr. Lord had not had sufficient information on the matter. The terms of tenancy differed in different places. For instance, a tenant in a Nindagama was different from a tenant in a Viharagama and a tenant in a Viharagama was different from a tenant in a Koralagama.

His Excellency the Governor said that he had listened to the discussion with interest and he felt with Mr. Godamune that the subject was of such importance that they could not come to a proper conclusion in the course of a discussion of an hour or an hour and a half. It had occurred to him that they might perhaps at that Conference appoint a Committee of the Conference to investigate the whole question of paddy growing and report their conclusions at the next Conference. It was the usual procedure in this country not to appoint informal Committees but rather to adopt the more formal procedure of Commissions. If such a procedure was adopted he would have no objection at all, but a body such as that Conference of people really interested in farming and acquainted with it from the practical as well as from the scientific aspects by investigating the various aspects touched upon might succeed in preparing a valuable report which would be a guidance not only to future conferences but also to the Government.

In reply to Mudaliyar Harry Jayawardene, Mr. Lord said that what he wished to emphasize was whether it would not be preferable to have a fixed rent. In the share system, however much the cultivator may improve the yield, be it by transplanting, weeding or the application of manure, he did not receive the full benefit of such work. If on the other hand, it was a case of fixed rent as in Jaffna, everything a cultivator did towards improvement went into his own pocket and it acted as an incentive towards improvement.

Mr. Stockdale suggested that perhaps it would be useful at that stage to adopt the suggestion of His Excellency and consider whether they should bring forward a resolution the following day recommending the appointment of a Committee to go into the matter.

Commenting on Mr. Lord's paper, he (the speaker) said that such differences prevailed in the different Provinces and in different parts of the same Province and such customs had grown up through generations of relationship between landlord and tenant, that there was no doubt that the paddy industry was at present in such a position that the whole system required to be reviewed from the point of view of the cultivator. That was what Mr. Lord emphasized in his paper. He had put forward the position of the cultivators and had intimated some of the difficulties that had to be faced.

His Excellency the Governor then thanked Mr. Lord for his very interesting paper. He also referred to the keen interest which Mr. Stockdale had taken in regard to the improvement of paddy cultivation.

Mr. H. L. De Mel was next asked to read his paper entitled "Some Aspects of Food Production."

Some Aspects of Food Production.

H. L. DE MEL, C.B.E.

ALL our food comes ultimately from the soil, and our prosperity depends very largely on our ability to use the soil to its full capacity. Mankind has been gradually developing methods of producing crops, but with our growing population in this Island and standard of material comfort, it is necessary to grow two or three blades where one grew before. If the soil were constant in composition for its various types, and if the climate was uniform, everything would be simple, but we are so regulated by the force of the monsoon, or the severity of the drought that the seasonal changes affect food crops seriously. We cannot, therefore, lay down a rule for universal cultivation. In these days, it is necessary to think harder than we have done before, as we have to face problems that have been rather shirked. Our Agricultural Department and its scientific staff are well equipped, and the services and assistance of the Economic Botanist and the Divisional Agricultural Officers should be more often sought after by us planters and small holders.

It is unfortunate, however, that we do not plan and toil enough with our minds and bodies to produce food and more food in lands which now lie idle or fallow. If we peruse the first table of figures attached to this paper, we shall see that we imported over four hundred thousand tons of rice annually during the last three years for local consumption; this, however, excludes what is produced locally. During the year 1919 to 1921, when Burma rice supplies had to be controlled, we undoubtedly grew more yams, cereals, pulses, and got on with less than three hundred thousand tons per year, but during the last three years, it has become necessary to import, roughly, a ton of grain for every ten people in Ceylon. Just think of that ! Thus compelling us to send out of the Island about 113¾ millions of Rupees of our money per annum for this class of food alone. If, however, we add the value of the food we import classified in Table C below, we import altogether over 134¼ million Rupees worth of food. We must remember this represents only the import value, and not the selling price to the consumer.

In the Southern Province where rice growing is profitable, it should be noted that large and extensive tracts of rice fields exist, and large herds of strong buffalos and a healthy manhood to tend and cultivate these fields are also available for producing food. In this Province, the fields yield a higher fold than in the average fields of the Western Province and North-Western Province, but the terms and conditions between absent landlords and the actual tiller are not too well balanced, owing to the unfortunate necessity of having an intermediary called (Gankaraya) who often deals in the seed paddy, supply of cattle, etc., without any loss of energy or sweat of his brow, and deprives the actual toiler of much of the fruits of his labour. May I respectfully appeal to the landlords of the Southern Province that if they really wish to see their fields yield more, let them secure pure line seed paddy, and allow more generous terms to the actual toilers. Their reward is sure and the country at large stands to gain. Is not the venture a necessity and worth a trial ?

The salient statistical aspects of the trade in food is set out in the tables as a schedule to this paper, and when it is thus briefly recapitulated, it can soon be realised what large quantities of our staple food we import, and the Customs export tables will further indicate that generally speaking we must sell nearly all our commercial products out of Ceylon, and import all our necessaries of food, clothing and everything else.

The country is, however, now more alive to the essential value of agriculture to the community, but what the country desires to know is how the people generally are to meet the increased cost of food and clothing in spite of the diminishing purchasing value of the rupee. Let us for a moment seriously think of just a few facts of economic importance; during the year 1927, we imported for our consumption the articles enumerated in Table B rice, grains, pulses, wheats, flour, arrowroot, etc., to the value of 113¾ millions of rupees (excluding food for animals). In Table C of the schedule, the articles of food imported other than grain indicates that over twenty millions of rupees are spent on them. These two classes of food, therefore, have an import value of over 134 millions, but the purchasing value to the community will be very much greater. These figures should inspire any of our potential farmers of the future with the possibilities there are for producing farm products as the demand for them clearly exists. In this large field of farm products much pioneer work remains to be done, and if certain difficulties are overcome, a fairly reasonable project should be carried out with success, more so if a series of such efforts were conducted by several farmers working on lines of co-operation, much good might result. In the Hiriyala Hathpathu working of the tobacco farms aptly illustrates co-operation in a remunerative undertaking, although it is at

times attended with loss of profit owing to adverse weather conditions. We should learn from rural Denmark, and the middle European countries where capital and labour are saved by the common establishment of sales, transport, stock exchanges, fodder crops, machinery, etc. I should like to draw attention here again to the tables in the schedule which indicate in unmistakable terms that our demand for both rice and grain is rising gradually year by year. We are at present happily milching the great Indian Cow and obtaining supplies of over 35,000 tons of rice month by month; yet there are millions in India itself who have hardly ever tasted rice for the simple reason that just now they cannot afford to buy that very useful article of diet. I feel strongly that as the economic and political development of India advances, India will not permit rice to be exported until all in India have had sufficient. If her statesmen and patriots really love the millions who are now under-fed, I have a strong presentiment that they will conserve their rice supply for themselves. What may our plight be then ? Have we ever given such eventuality any serious thought ? Last February, while in India, I discussed this problem with several members of the Bengal Legislature, and one member from the Burma Council, and I reiterate what I have just said.

We now rest satisfied that our lands are too valuable for rice. Our rubber, tea and coconuts give us better returns, why therefore should we not buy food in the cheapest market ? This satisfies us now and had for years till the rice crisis of 1919 to 1921. Are we not hoping to grow food along the Batticaloa Railway Line ? What are those enthusiasts doing who wanted that Railway ? Will they not put any capital towards land development ? A very heavy charge of over 21 million rupees has been made on the State's Exchequer to build this Railway ostensibly as a food-producing asset. Some of us opposed the heavy and extravagant expenditure, nevertheless the present generation must bear the sinking fund interest and loss in the working of the line; these will be annually recurrent charges; it behoves, therefore, those of us who love our country, and would do all in our power to develop it with our capital and brains to establish some food production, agricultural or farming schemes along the miles and miles of land through which this Railway traverses. I am ready and willing to follow any enterprising pioneers, and shall not only subscribe capital, but be prepared to serve. Ceylon is predominantly agricultural and we must advance on progressive lines to develop our inheritance from within. I venture to think that all our rural youths whose ancestors have for ages cultivated the soil to satisfy their needs, and had little enough to spare, must be shewn that, with judicious cultivation, such as correct selection of seed paddy and the proper use of ploughs, cattle, manure, rotation of crops,

etc., it is possible to produce two or three times more food than their ancestors. If we do not foresee this, and train our youth, what is likely to befall Ceylon as an agricultural country ? Each country must work out its own inherent genius. A small portion of the youths from both towns and villages are drifting towards industry and mechanical transport, but we must remember that our prime income and 75 per cent. of our prosperity will always remain agricultural; most foodstuffs can doubtless be profitably grown. I do not propose to enter into a discussion of the maxim —will it pay—but would like, in passing, to observe that I have found an acre of chillies give Rs. 187·50, an acre of onions Rs. 105·00, an acre of tomato nearly Rs. 100·00 all nett profit. If the market is close at hand, and packing and transport satisfactory, profits could be more favourable. Let those who have both the requisite knowledge and means lead the way, and let us not be down-hearted, but keep on plodding tenaciously but gradually year by year till success attends our universal efforts.

At a meeting, over ten years ago, on the 3rd March, 1917, as Chairman of the Low-Country Products Association, in reviewing the agriculture of Ceylon at its Annual Meeting, I made use of the following words:—

> " The rainfall during the early months of this year augurs well for agriculture. There are lands that will grow only food crops for local consumption, and with lessons taught by the War and teachings of modern science, such as rotation of crops, dry-farming and the conservation of moisture, a determined effort must be made to produce as much local food as we can. The main object of investing in only profitable crops depending on an external trade to sustain has gradually but completely obscured the more economic and domestic need of staple food supply. This is regrettable. May I appeal to all Agriculturists who have at heart the true interests of the country to make efforts in the direction of growing regular food crops by working more in co-operation with the Ceylon Agricultural Society, the Department of Agriculture, the School Gardens and the village cultivator."

Speaking personally since that date, on the estates and lands under my control, I have systematically grown all manner of food crops, and I wish to bring a few suggestions, bought of experience, which may perhaps help us to realise that, for a systematic and intensive cultivation of food crops which include pulses, cereals, yams, vegetables, plantains, jak fruit and breadfruit, there is the greatest possible scope at profitable rates before us always.

The then Secretary of the Board of Agriculture had requested me to read a paper at Matara on Growing Food Crops at a meeting held under the auspices of the Board on the 20th of June, 1919. I gave my experience of the rather poor response we had from Government Agents and recounted my experiences from April, 1917, to date of that paper. Mr. Drieberg, the Secretary of the Board of Agriculture, also published a paper a few months earlier entitled "Suggestions for securing a larger food supply in the near future." About this time, the representations of a few keen agriculturists moved the Government that a real attempt should be made to deal with the matter—the rice crisis in India was acute, and a Food Control had also to be appointed to secure relief for the millions in Ceylon who were used to buying imported rice, including our own estate labourers, and most of the population in towns. On the 5th February, 1920, the Government appointed a small Committee to consider what measures should be adopted to make Ceylon self-supporting in regard to its food supply. On this Committee of Eleven, we had no less than four members of the Low-Country P.A., and we submitted our report in less than a month (vide Sessional Paper No. 2 of 1920). Resulting from this Report was the inaguration of the Food Production Department with Mr. E. B. Denham as organiser, and the Colony of Nachchaduwa was also another result. There was also the rise and fall of the Minneriya Development Company and the opening of new land under the Kirindi Oya Scheme taken up by the Low-Country Food Products Co. Just about this time, thanks to the enterprise and ingenuity of two young friends from the Southern Province, Messrs. A. Weerakoon and T. Senaratne, I was associated with them in opening out a rice hulling and milling plant at Ambalantota. This was followed by the Government within a year's time doing the same thing in Anuradhapura with similar plant to be worked with prison labour, and then later, Mr. W. A. de Silva, who also hails from the Southern Province, not only started a rice farm, but after considerable trouble and expense now mills rice himself.

I have for the past three years been buying some 500 to 600 bushels of rice regularly from him every month for my labourers in Kurunegala to supplement my own smaller efforts in local rice growing. I am now erecting Mills at Kurunegala for milling rice raised by my neighbours and myself. Another enterprising planter has erected Rice Mills not far from Negombo, and he is doing a great service to his neighbours, while in the Central Province, there are one or two Mills in working.

Besides rice and grain, we consume very largely vegetables, yams, cereals, pulses and wholesome fruit. Every Owita or low-lying land, or abandoned field, or uncultivable field can be made

a most potential yielder of food products. Here the soil has to be worked deep, the seasons studied, and the right commodities planted during the correct season. If planters of this country, like ourselves, grow food crops on progressive lines, we can easily get our village neighbours to grow what is readily consumed. There remains only one thing to make the effort a success, and that is to secure the easiest and best market for the villager to obtain proper value. Since the War, it has been a pleasure to notice in the Western and North-Western Provinces especially the weekly market fairs. I have had experience of two fairs, which are conducted on my own estates, where I have been recently compelled to erect permanent buildings with water service and sanitary comforts owing to the very large crowds of both sellers and buyers who make use of an organised market. These constitute a real service to the villager, and must be conducted under sanitary and clean conditions. If, however, the Village Co-operative Society lends money, the villager can produce more and also earn still more using such fairs for a weekly turnover of his produce. In most of the Provinces, the rainfall is certain, and cattle manure available for a more regular cultivation of vegetables, cereals and yams. The Food Products Committee of the Board of Agriculture should make a more concerted attempt to stimulate the growing of these products, and possibly detail a special officer to follow up the work. Of late, I have observed with a thrill of pleasure serious and practical efforts by several Food Productions Committees and Associations especially in North Ceylon and Matale, which clearly demonstrate that most of us must do more community work and propaganda.

Few of us realise the very large part cattle in this country play in the agricultural life of the people. It is, however, equally surprising to see that, in spite of the fast locomotion on public roads and railways, cattle continue to be allowed to trespass, and do not seem to be specially cared for by their owners. The excuse is often made on behalf of the villagers that pasture reserves are not provided in villages. If such reserves were available, one doubts that many cattle would be led into such pasture reserve to be kept in safety. During a recent visit along the new Batticaloa Railway Line, where I spent some four days, I was impressed with the large number of privately owned buffalos which were trespassing on the Railway Lines. As a member of the Railway Advisory Board, I called for a return of cattle run over on the Railway, and received the following figures:—

1923-24	...	...	510
1924-25	...	...	551
1926-27	...	...	806

Taking the 1926-27 figures, of these 806 cases, the Railway Inspectors prosecuted the owners in no less than 464 cases, and secured convictions against such owners in 402 cases. These figures show what a tremendous loss the agricultural interests of the Island have suffered by the untimely death of so many cattle within the past three years in a way which, with precaution and care, could largely have been averted. Public notices have been issued by Government Agents, and the public requested to assist the Railway authorities by not permitting cattle to stray. I venture to ask whether something more cannot be done to encourage the tethering of cattle, and securing pasture for them at nights. Excuses can, of course, be made, but has any attempt ever been made to have proper herdsmen ? In India, large herds of buffalos are regularly tended and fed by say two boys both of whom very often ride on the backs of the animals. Being so domesticated, and under the immediate control of such boys, these cattle are saved from self-destruction and trespassing on crops and plantations of others, and I personally think that village cattle could be tended and made more domesticated by shewing greater kindness to them, and by feeding them in open reserves under adequate control. These animals are most essential to mankind in growing food and for transport, and apart from the State aid now rendered to prevent infectious and contagious diseases of animals spreading throughout the country, we must gradually evolve a system of conserving food for agricultural cattle and tending them. We may then secure, amongst other things, their milk for the nourishment of the village babies, children and expectant mothers, and thus secure a more vigorous manhood for the future. I have not referred to the use of animals for human consumption, and what economic bearing it has.

The success of any sustained attempts to grow more food will largely depend on the measure of support the village cultivator gives to it, and I would commend the scheme of organising continuation schools for training the village youth in practical agriculture. After the elementary free education now imparted, which ends when a youth is 14 years old, there should be continuation classes. Perhaps the same school buildings might be used if 2 or 3 acres of land could also be secured, and an attempt made to grow food by co-operation on a profit-sharing basis. The training of teachers for this special purpose seems to be of paramount importance, and I believe Mr. Stockdale has some scheme in view. Just now one notices children carrying manure daily for use in school gardens. I learn there is some grumbling amongst parents and children, when the profits of these gardens go to the Head Teacher ! Most of these children need guidance and tuition from between the ages of 15 and 18, and if the correct methods can be found, and the youth trained to the avocation

adapted to his environment, we are sure to have potential farmers engaged in this most useful and profitable occupation with benefit to themselves and with profit to the whole country.

In conclusion, I would express the hope that some of these thoughts would stimulate those of us who are engaged, or who can engage, in food production to do more in making serious attempts to grow food of various descriptions, including all kinds of fruits, in the years to come. By producing food accessible to the consumer at a cost which will be reasonable, we shall bring about more contentment as the cost of food is undoubtedly the largest item in the family budget of the average daily labourer. The producer in turn will have his own compensations.

Table "A"

Imports of Rice during the period 1917 to 1926.

Year	Rice Tons		Year	Rice Tons
1917	387,706	...	1923	371,191
1918	323,607	...	1924	375,959
1919	262,128	...	1925	416,069
1920	289,436	...	1926	439,747
1921	292,997	...	1927	454,363
1922	360,457	...		

Total Population of Ceylon.

1901		...	3,578,333
1911		...	4,110,367
1921		...	4,504,549
1926	(estimated)	...	5,047,632

Table "B"

Rice, Grain, Flour and Mill Products Imported.

1927.				1926.		
Tons				Tons		
439,747	Rice	...	Rs. 98,061,620	... 454,363	...	Rs. 102,851,651
32,598	Paddy	...	,, 3,305,624	... 24,082	...	,, 2,228,121
13,357	Grain and Pulses	...	,, 2,693,739	... 17,570	...	,, 3,761,099
66	Wheat	...	,, 13,727	... 73	...	,, 1,358
47	Other Grain	...	,, 7,880	... 38	...	,, 6,222
17,953	Flour Products	...	,, 4,307,884	... 19,494	...	,, 4,678,723
33	Barley, Oats, Maize, etc.	...	,, 15,997	... 73	...	,, 27,612
937	Arrowroot, Tapioca, Sago, etc.		,, 219,900	... 788	...	,, 193,735
72	Other Products	...	,, 20,389	... 93	...	,, 34,494
504,810	Tons	...	Rs. 108,646,769	... 516,521 Tons		Rs. 113,795,246

Table "C"

Articles of Food Imported to Ceylon Other than Rice and Grain.

Last Two Years Compared.

Article		1926. Quantity	1926. Value	1927. Quantity	1927. Value
			Rs.		Rs.
Beef, frozen	Cwt.	5,083	193,525	5,514	206,897
,, tinned or salted	,,	468	30,287	488	28,526
Mutton, frozen	,,	3,637	163,248	4,124	181,936
,, tinned	,,	92	8,713	59	5,718
Bacon, ham and pork	,,	4,009	492,899	4,120	462,183
Other meat	,,	259	19,718	398	20,786
Poultry and game, alive	No.	200,140	168,699	281,204	242,447
Do do dead	,,	35,482	73,312	38,899	61,256
Butter, frozen	lbs.	293,656	312,012	361,632	378,255
,, tinned	,,	341,177	297,568	329,303	293,168
Cheese	Cwt.	441	38,665	2,010	177,688
Eggs	Doz.	658,350	246,761	879,890	342,853
Fresh Fruit	Cwt.	19,891	586,471	21,501	685,894
Milk, fresh or frozen	lbs.	826	1,778	573	1,424
,, full cream	,,	1,267,359	925,361	1,305,592	1,000,039
,, skimmed	,,	385,655	104,049	464,153	114,361
Ghee	Cwt.	5,165	347,439	6,515	388,167
Onions	,,	432,905	3,891,686	523,856	4,459,895
Potatos	,,	347,191	3,022,658	257,580	2,421,365
Other raw vegetables	,,	12,439	36,812	23,125	79,725
Fish, cured and salted	,,	355,737	3,731,522	380,757	4,017,079
,, frozen	,,	812	60,137	895	64,461
,, maldive	,,	66,254	5,038,176	76,391	4,865,475
			Rs. 19,794,696		Rs. 20,499,596

Table "D"

The Blue Book gives the following acreages under various crops, produce thus secured, and the imported food together must provide all the food the inhabitants of the Island consume besides animal food and fish.

Paddy	...	834,325 acres
Chena product	...	77,316 ,,
Grains other than chena	...	26,981 ,,
Vegetables	...	30,843 ,,
Sugar cane	...	901 ,,

The Discussion on this paper was postponed for the following day.

Wednesday May 9, Afternoon Session.

Inspection of Laboratories and Experiment Station, Peradeniya.

Inspection and Prize-giving at the Farm School, Peradeniya.

Order of Proceedings.

Inspection of the Farm School - 4-30 p. m.

Prize-Giving - 5-15 p. m.

1. Report by the Vice-Principal.
2. Distribution of Awards and Certificates by His Excellency the Governor.
3. Address by H. L. De Mel, Esq., C.B.E.
4. Vote of thanks to His Excellency the Governor, by the Director of Agriculture.

Prizes.

For the Science of Agriculture.—Presented by Sir Solomon Dias Bandaranaike, K.C.M.G., awarded to Victor E. P .Gunaratne.

For Agricultural Practice.—Presented by Gate Mudaliyar A. E. Rajapakse, awarded to W. Nicholas Fernando.

Tour Essay Prize.—Presented by the School Staff, awarded to Victor E. P. Gunaratne.

Budding Prize.—Presented by T. H. Parsons, Esqr., awarded to W. Nicholas Fernando.

Certificates.

First Class.—Victor E. P. Gunaratne.

Second Class.—W. Nicholas Fernando, Don Jusey William, Samarasekera Banda Udurawana, D. Benjamin de Silva.

Pass.—M. Gregory Fonseka, Nallaratnam Kanagaratnam, George B. Senaratne.

Sinhalese Teachers' Course, 1927-28.

Awards.—Medals awarded by the Director of Education: Silver Medal for First place on Course—Awarded to Ratnayake Mudiyanselage Ekanayake.

Bronze Medal for Second place—awarded to Saputhanthirige Gomis Sugathadasa.

Certificates (Names in order of Merit).—Ratnayake Mudiyanselage Ekanayake, Saputhanthirige Gomis Sugathadasa, Pulukutti Mudiyanselage Don Brampy, Vithanage Geeris Jayawardena, Yapa-appuhamilage Don Charles Wijeratne, Wathulande Siriwardena Ratnayake, Hewaussaramba Bardias Sugathadasa, Minuwandeni-Pathiratna Don Herat, Mullevidanelage Don William, Koralage Luwis Tissera, Manatunge Aratchige Methias Perera, Don Sadiris Kasthuriratne.

Report of Vice-Principal.

Mr. Burnett, Divisional Agricultural Officer, Central, Vice-Principal read the following report:—

The prize-day to-day is the eighth gathering of its kind. The School started in temporary buildings in the Royal Botanic Gardens in 1916. Four years later, 17½ acres of its present home were purchased by Government and two years later the buildings you now see around you were completed. More recently we have had a further 8 acres added from the area acquired by the Department from New Peradeniya Estate.

The Agricultural School does not confine its activities to these 25 acres of land; because we are permitted to do part of our work in the 150 acres covered by the Royal Botanic Gardens and in 300 acres covered by the Experiment Station at Gannoruwa. During the twelve years the School has been in existence, 186 men have qualified in the practice of Agriculture on the English side and 157 on the Vernacular. 121 of these latter were Sinhalese School Teachers and 36 Sinhalese and Tamil Headmen. A dairy (now consisting of 27 head of pure-bred Scind cattle), an Apiary, and poultry have also been started in conjunction with the School.

Staff.—Mr. St. L. H. de Zylva is back in charge as Headmaster after an absence of 5 years. He had previously been in charge for 6 years from the inception of the School as Registrar. Mr. R. S. D. Jansz resigned his post as Science Lecturer and has taken up Science teaching at St. Thomas' College, Mt. Lavinia; this work is temporarily in the hands of Mr. D. J. de Soysa who has recently come to us with the Diploma of the Poona College. Mr. J. A. Alles and Mr. S. Sangarapillai remain with us. Mr. C. A. Perera, the Vernacular Instructor who replaced Mr. C. Wickramaratne, has yielded to the temptations of a post at the Government Training College, and this vacancy has just been filled by the appointment of Mr. K. A. J. Perera, Vernacular Agricultural Instructor.

Syllabus.—At the beginning of last term a new syllabus was introduced into the School and I wish to make reference to Mr. Drieberg, our late Farm School Officer, for his help and for the hard work he did in connection with this prior to his departure. Headings for over 1,200 lectures and practical demonstrations were drawn up and dovetailed in, to cover the whole period of 2 years.

To-day we are met for the award of prizes and certificates earned since 1927, viz., by 8 English students and 12 Sinhalese Teachers. This English class commenced the session with 16 students in May, 1926. Only ten commenced their second year and of these eight reached the requisite standard of efficiency at the end of the course last March. Four prizes have been awarded to the class, besides certificates. All 12 teachers who were admitted to one year's course in Rural Science in May, 1927, have also completed the course satisfactorily and are to-day being awarded two medals in addition to certificates. Both classes maintained a high standard throughout their courses in all respects and merit warm commendation. Indeed two of the English class reached so high a level that they have been offered appointments in the Department.

The Old Boys' Union has not yet given evidence of vitality. It was inagurated on Prize-Day, 1920, eight years ago. I am told that it had a vigorous christening party a year later, in September, 1921, when the members foregathered and lunched distinguished guests. Since then it has lain dormant and an effort to revive it this year has evoked a faint kick. This proves at least that it is not dead altogether and may yet burst into the vigour of its youth, fulfil its object of maintaining interest and fostering fellowship between past and present students by mutually rendering professional assistance.

One-third, over 60, of the passed students are serving in various posts of the Department. Others who took up billets on Estates have made names for themselves by a high standard of work and by devotion to duty. It is our pleasure to congratulate Mr. T. Kotani on the distinction of being appointed Vice-Consul for Japan at Batavia. We very much regret to record the death of two old boys: Richard Cameron in East Africa and J. D. Nicholas. These references are by no means complete, but we are hopeful that with a revival of the Union we shall be able to maintain a closer touch with all old boys and their doings.

The Apiary has recently been moved to a more sheltered site along the bank and a beginning made with bee pasture. Bee-boxes have been made and supplied to a growing clientele and signs are not wanting that this splendid hobby will become more widespread.

As regards poultry the leghorns have been more successful than the Rhode Island Red and Australops. The leghorns have given an average of 225 eggs per bird during last year. Interest in poultry farming is growing in the School now that instruction in this subject is a regular feature of the course.

The Dairy has more than maintained the good name it enjoys. The Assistant in charge, Mr. Sangarapillai is an enthusiast. Special attention is paid to costs, accounting and to the recording

of the yields of milk from individual cow. The demand for milk is insistent and with the good name earned by the Dairy staff for safeguarding the supply against adulteration, this demand is rising. Indeed the School staff were recently warmly complimented by the Medical Officer of Health, Kandy Municipality, and in a log-book entry, he expressed his regret that we could not increase our herd so as to supply the needs of Kandy. However, ours is intended for instructional purposes chiefly and all we can offer beyond a very limited local supply of milk is an invitation to all interested to visit the Farm and Dairy whenever they can do so and see how things are done. We are always happy to show visitors round.

While Horticulture and planting is taught outside our limits, we have utilised our grounds fully for experimental trials with several crops. During the last Maha season, the paddy-field was worked entirely by students, from start to finish, i.e., from ploughing to threshing, and an experiment with four pure-line paddies and one local variety was conducted. The yield for 9/10 acre was 38 bushels and 12 measures. Pulses and green manures have been sown in this field for the Yala season. The plantain area was cut out in order to eradicate "Bunchy Top" and planted temporarily with Guinea Grass. The coffee has been heavily pruned and may need replacing. We now sell our tea as green leaf and our rubber is sent to the Experiment Station, Peradeniya, as wet latex as the methods of manufacture are studied there. A new paddock has been laid out for big calves and dry cows, and the 8 acres under Guinea Grass have been kept weeded and manured. Only in the very dry months do we suffer from shortage of grass and we then draw on the acre planted on the Gannoruwa river bank. In the area just across the path a 3-course rotation of crops is practised by students and has given fair results.

The activites of the School outside academic studies have been manifold. Recreations include tennis, volley ball, cricket and football. A mountaineering club has been formed and has already numbered among its triumphs Pidurutalagala, Adam's Peak, Hunasgiriya, Bible Rock and Gannoruwa Hill. A Glee Club has met weekly in term time and has contributed greatly to the gaiety of the social side. A Reading Circle has had many meetings and has helped to keep a lively interest in the latest literature. The Debating Society has had eight lectures including three illustrated by lantern slides. Copy has been prepared for the issue of the sixth number of the School Magazine—*The Peradeniyan*; also three dinners and several social functions have also enlivened the year.

The Athletic Sports Meet was held in March and the prizes awarded will be distributed this afternoon. A ploughing contest

and a cross-country run of 5 miles were the most notable features of the Meet. The winner of the championship scored 46 points and he is to be congratulated on such a fine lead over the second, who scored 36 points, and the third 34.

The newest departure has been the introduction of Rovering in both English and Sinhalese classes. The whole of the latter class of 12 men took a year's training with a week-end Camp at the close in March when they were invested as Rovers by the Headmaster. The investiture of the Agricultural Rovers of the English section was made by His Excellency the Governor on his visit in July last—a distinction that remains to inspire all their efforts.

Our visitors during the year have included His Excellency the Governor and Lady Stanley, Col. Summers, Dr. Williams, Medical Officer of Health, Kandy, the Professor of Agriculture at the Poona College, and the Principal of Dr. R. Tagore's School in Bengal, and others.

I also wish to mention that the success that has been achieved during last year reflects credit on the Headmaster and the staff. They have spared no effort to give of their best in all directions.

In conclusion I take this opportunity of thanking the donors of to-day's prizes and the many people who by their presence here this evening have evinced an interest in the work of this Institution.

Governor's Address.

Before distributing the prizes and awards His Excellency said he was sure his audience had listened to the report with as much pleasure and interest as its reading had given him. It was certainly a very satisfactory and gratifying record of good work done in a good cause, and the Vice-Principal and Headmaster were to be congratulated on the success that had attended their efforts. Those who like himself, had had the privilege of looking round the school that afternoon, would have been able to see for themselves what very good work was being done and to see that it was being done in a practical and helpful way. The school was teaching young men and the older teachers things which would be of practical use to them and of very great use to those with whom they might come in contact, and to whom, he hoped, they would be able to impart the knowledge which they had acquired at Peradeniya. He had always made it a point to talk about the agricultural bias in education at every opportunity. At Peradeniya, at any rate, an effort was being made to give that bias to students and vernacular teachers in what he thought was the best possible way, that is, by the actual practice of agriculture in its various forms. He did not propose to make a speech that afternoon. Those present were to have

the pleasure of listening to an address by Mr. De Mel, who had forgotten far more about agriculture than he would ever know—and, His Excellency added, he would not attempt to compete with Mr. De Mel.

There were, however, one or two points in the report on which he might perhaps say a word in passing. He would, first of all, like to express the hope that the Old Boys' Union would see to it that it did not become defunct. He was a great believer in the keeping alive in a student when he left his school, the ties of friendship and ties of interest which bound him to his contemporaries. This was very easy to achieve, if one took just a little interest in it. On the other hand, if one became slack about it, and the society once started, languished and died, it was not easy to revive again. He thought that there was still time for them to revive the Old Boys' Union, and he hoped that when he visited the school next year, that it had had as successful a meeting as its first christening meeting. He was glad to know that some of the students of the school were going to give the Department of Agriculture the benefit of their services. He hoped that the others who were going out into the world, some as estate owners, others as teachers, would not forget the lessons they had learnt at Peradeniya, but would be able to put them to practical use to the great benefit of themselves and of their fellow-countrymen.

He was glad to hear that the athletic and recreational side of the life of the students was not being neglected. It was a good thing to keep the body as well as have the mind instructed and a little healthy recreation would make them all the more capable of doing good work. The Governor next referred with pleasure to the interest taken by the students in the Scout movement, and declared that as Chief Scout of the Colony the movement and all that pertained to it was a matter of great concern to him. He was glad to know that young men of the class and the prospective students were taking an active interest in scouting, because they would be able when they went back to their own parts of the country to create interest in and extend the movement.

In conclusion the Governor again gave expression to the pleasure it gave him to visit the school and hoped that the young men who were leaving it would not fail to look back in after life with gratitude to the school and those who had helped them in what, after all, was the basic industry of this island.

His Excellency, on behalf of the students, also presented Gate Mudaliyar A. E. Rajapakse, who forty-three years ago was a student of the old Agricultural College, with a handsome silver-mounted walking stick, of Kandyan workmanship. The gift was a token of the esteem and gratitude of the students towards Mudaliyar Rajapakse.

Mr. H. L. De Mel in the course of his address referred to the Conference now being held and stated that such occasions were afforded to agriculturists so that they might assimilate the experiences of others and correct mistakes, which they were all guilty of. He said " I want to ask you young students not to be ashamed to own up when you make mistakes. This is one of the weaknesses of my countrymen. We never own up our mistakes. Please do not let that happen in your lives."

Speaking of the village agriculturist Mr. De Mel said, " In this country on almost every public occasion most of us express great solicitude for the villager and in our solicitude sometimes blame the Government and the Governor for not taking a greater interest in him. It is up to us who have had a better education than our village brethren to do our little bit so that we may bring home to him what we have learnt. The liturgy of the village "goiya" is well worth knowing. There is always a science behind his custom, and it would be a good thing for you and for me if we looked into his case with interest, if we talked more with him and tried to discuss matters pertaining to agriculture with intelligence."

At the conclusion Mr. Stockdale, on behalf of the school and the visitors, thanked His Excellency for presiding at the function and for giving away the awards. Throughout the time that His Excellency had been in the island he had evinced the greatest interest in educational and agricultural matters, and his presence at the school that afternoon was another proof of a keen desire to help in every way to foster the agriculture of the country.

His Excellency on taking his departure was loudly cheered by the students.

Evening Session.

The use of the magic lantern for pest protection work by Mr. N. K. Jardine, F.E.S., Plant Pest Inspector, Central.

Mr. Jardine indicated the uses and limitations of the magic lantern for educational work amongst the village cultivators in regard to plant protection work, and illustrated his remarks by a number of slides.

Thurday, May 10, 1928. Morning Session.

His Excellency the Governor said that they had met half an hour earlier than usual in order to discuss the paper on food production by Mr. H. L. De Mel.

Unfortunately Mr. De Mel was unable to be present but he did not think Mr. De Mel's presence was absolutely essential for its discussion.

Mr. J. C. Drieberg referring to the remarks made by Mr. De Mel in regard to agricultural education, said that the means by which that matter could receive attention was by actual vocational instruction and by giving the necessary bias to general education. He (Mr. Drieberg) said that the fact that a general education was essential should be stressed more forcibly in vernacular schools. That was now made possible since a definite syllabus in rural science had been drawn up and made compulsory. The more important part of the syllabus was the second part, in which definite agricultural knowledge was included. But that work was to start only from the sixth standard. Unfortunately there would be little scope for the application of this work and its influence upon village education could only be slight, because the number of pupils in the higher classes of the vernacular schools was not high. Hence it might become necessary to consider the restricting of this higher agricultural education to certain schools, the work of which should be gradually adopted till they reached a stage when they could be developed into central rural schools. For this it would be necessary to have sufficient land, about five acres or preferably 10 to make possible the achievement of Mr. De Mel's idea of profit sharing; but this idea could not be carried out at present in village schools.

Referring to English schools, Mr. Drieberg said that it was essential that the course in science should be so modified as to be of greater parctical use. At present instruction in science was confined mainly to chemistry and physics and biology received but scant attention. Examination results in botany were also not satisfactory. He wouldd like to insist on the desirability of making agricultural science a compulsory subject in the Cambridge examinations.

Mr. K. Bandara Beddewela said that Mr. De Mel had given figures with regard to the importation of rice and other cereals to Ceylon. By experience they had found out that those products imported to Ceylon could be grown in the Island. He (the speaker) wished to mention that in his opinion if Revenue Officers and Headmen could be made to take interest in their work, and with the aid of the Co-operative Societies the "goiya" would be able to raise most of these products and make chena and paddy cultivation a paying proposition as far as the "goiya" was concerned. It was absolutely essential that Revenue Officers should fall in line with the Agricultural Department. The "goiya" from the time of the British occupation was used to a certain official and that was the Government Agent whom he called father and mother. In most parts of the Island, the hard working "goiya" could not make ends meet. Dr. Silva had remarked yesterday that the backwoods could be improved if some interest was taken to better the conditions of the people there. If it was the intention of the Government to make Ceylon self-supporting, he thought that all public works would be laid by until one at least of the irrigation schemes was put through.

Mr. Brayne said that with regard to the statement made by the last speaker and other speakers that Ceylon had been self-supporting a little over hundred years ago, but that now Ceylon depended on foreign countries for two-thirds of her staple food, they should not lose sight of one point, viz., that

when Ceylon was self-supporting, a very much larger proportion of the population concentrated their attention on agriculture. Since then a large number of other activities came in with the progress of Western civilization, and paddy cultivation fell to a comparative minority. Therefore, if he was going to produce enough grain for the population, he had to produce a very much higher proportion than he did in the olden days.

MR. DE MEL had also spoken of the possibility of the Indian politicians stopping the export of rice from India to Ceylon. He (the speaker) would not say that such a thing was impossible, but if the Indian politicians did such a thing, they would certainly not be benefiting India. They would be doing their own country as well as Ceylon considerable harm. In his (the speaker's) opinion, such a measure would not feed one extra man of the people who were insufficiently fed now in India. The economic measure and the standard of living of the Indian paddy cultivator would drop and they would do the people of India far more harm.

He (the speaker) said that four factors should be considered when considering the problem of food production, especially paddy production. They were (1) land which could be made available, (2) water which could be made available by irrigation works, (3) Capital, the best way of supplying which was by Co-operative Societies, (4) the paddy cultivator. He thought that in the past in pushing paddy cultivation, they had rather tended to concentrate upon the first three and consider the last only incidentally. In his opinion the paddy cultivator was the factor to be studied if they were going to do anything towards improving paddy cultivation. The cultivator had certain peculiarities which had to be considered. For instance the cultivator did not like to be removed from his village. In nine cases out of ten when they found a paddy cultivator, they should supply him with land, water and capital within reasonable proximity to his village. The Minneriya Irrigation Scheme was a splendid one, but cultivators had not taken up lands there.

MR. MUTTIAH.—We all as human beings like to get money at a low rate of interest. Speaking about the cultivators of Batticaloa, I may say that they were used to securing loans with 50 to 75 per cent. interest until Mr. Brayne interested himself in the Co-operative System and since then we are grateful to him for having brought down the rate of interest to 12 per cent. I think it is a very reasonable rate. If money could be got at a lower rate of interest, certainly it would be a good thing, but I think it is not a wise policy to lend money at a lower rate because it would not be an inducement to work hard.

Continuing Mr. Muttiah said that Mr. De Mel had complained that the people of Batticaloa who wanted the railway had not developed the vast area from Minneriya to Batticaloa. Though the people of Batticaloa were famous musicians and charmers, they were not such great charmers as to develop that vast area within three months. He was sure, however, that when the time came, Mr. De Mel and those who spoke like him would find that the people of Batticaloa would supply a good number of cultivators to develop that land.

MR. STOCKDALE said that Mr. De Mel had emphasized that by the system of mixed farming on dry land, a greater percentage of food could be produced in Ceylon, and with that point, he was entirely in agreement. There was no doubt that much more food could be grown on dry land in Ceylon than was done at present. It involved capital and a considerable change in the system of agriculture from what was known in the Island at the present time, but it could be done.

Mr. Brayne had indicated the factors which influenced paddy cultivation. He would like to carry Mr. Brayne's remarks a little further and add to his 4 points another, which he thought was equally important, and that was the marketing of produce once it was grown. The great difficulty in rural

areas was the marketing of produce, and they should devise some means of assisting the rural growers in the disposal of their produce, because unless that was done, they could not expect them to grow more than what they needed for their own consumption. In conclusion, the speaker said that the matter could be discussed in detail in connection with the paper by Mr. G. Robert De Zoysa.

His Excellency the Governor said that they had a very interesting discussion, and he thought that they would like to express their appreciation to Mr. De Mel for his interesting and stimulating paper, and although they would not agree with all the points expressed in his paper, they were all in agreement with the main trend of his arguments. It was very desirable that the people of Ceylon should produce a fair share if not all the food they consumed. Of course, their ideal was that Ceylon should be self-supporting, and that was an ideal towards which they were working. Anyway, their policy should be directed towards encouraging the growing of food of various kinds. He was glad to know that there was general agreement of those present in that hall that that was a matter that should receive the earnest consideration not only of Government, but of the people themselves. It was most desirable and important that the people concerned should do what they could, and especially those who were fortunate to possess worldly wealth and education. They should interest themselves in the question and contribute what they could to attain the object. He agreed with Mr. Drieberg on the question of an agricultural education. He said that it was an ideal to have in every village school proper agricultural education. But it was impossible in a short time to train every village school teacher even if provision were made. What he would emphasize was the inculcation of the village teacher with a right outlook towards agriculture—an outlook which would lead him to look upon agricultural life as not in any way inferior to that of people who wore white collars. If he (the teacher) had that point of view himself, he thought that it would gradually spread from him to every intelligent village boy not to go to town life but rather to return to his ancestral fields and see whether he could not make a better use of them than his father did with less instruction. The tendency in education was such as to influence the educated boy to become a clerk or something of the kind. He did not wish to insinuate that clerks were not necessary or that the occupation of the clerk was inferior to that of the agriculturist, but the opportunities for the employment of clerks were limited and very soon the market of their service would be overstocked and a lot of young men would be hanging about looking for clerical work at less than an economic wage and this would mean that the cultivation of large tracts would be neglected for want of people to settle down to work them. He hoped, therefore, that their educational system might be so formed as to have the desired psychological effect on boys who attended schools. That was really what they were aiming at. Of course, it would be better if they could have as village teachers men who were trained in agricultural science, and possibly in course of time they would be able to work up to the realisation of that ideal.

He did not want to say anything more about the question of interest charged by Co-operative Societies. It was a difficult question and he was very careful on that not to commit himself to any figures. He did not wish to say whether 12 per cent. was fair or not. The four main principles which ought to guide those Societies were firstly that the fixed rate should not be so low as to encourage improvident borrowing; secondly, the rate of interest should not be so high as to hamper legitimate enterprise; thirdly it should be such that Co-operative Societies should be able to carry on their work on sound business lines; and fourthly, it was not the business of Government to subsidise them in their commercial operations, though it might be necessary to help them at the start.

His Excellency then called upon Mr. M. Park to read his paper entitled "Investigation of root diseases of coconuts."

Investigation of Root Diseases of Coconuts.

MALCOLM PARK, A.R.C.S.,

Assistant Mycologist, Department of Agriculture.

General.

ROOT diseases of coconut have received comparatively little attention from mycologists. The coconut palm does not appear to succumb readily to the attacks of root fungi and it is unusual to find what may be termed spectacular instances of death by root disease. The coconut is a monocotyledon and perhaps a brief statement of the essential differences between the root systems of monocotyledonous and dicotyledonous plants will render clear the possible reasons for the apparent resistance of palms to root disease.

A dicotyledonous tree has a tap root and a few stout main lateral roots which are firmly embedded in the soil and which are immovably connected with the stem which they hold erect by their own rigidity. The main lateral roots branch irregularly and from these in succession arise smaller roots until finally are found the feeding rootlets which take up water and dissolved salts from the soil through root-hairs. All the roots of a dicotyledon are capable of increasing in size with age by secondary thickening.

The coconut palm, being monocotyledonous, does not form a tap root. It produces, and continues to produce throughout its life, roots from the base or bole of the stem. These are the main roots of the tree and they are very uniform in size. They radiate in all directions from the base of the tree and tend to keep more or less in the direction in which they start; they branch occasionally to form straight-growing roots of much the same size as themselves. From these main roots arise small branching roots which are the feeding roots of the palm and which are short-lived and replaced frequently by fresh rootlets.

The root system of the coconut thus differs from that of a dicotyledonous tree in the absence of a tap-root, the development of all the main roots in succession from a definite root-bearing area at the base of the stem, and the uniformity of size and flexibility of the roots. If a root of a palm is damaged so that the tip or growing point dies, it either forms a fresh branch root behind the

point of injury to replace the original root or else another dormant root in the bole commences to grow and take its place. This faculty for replacing injured or diseased roots is of importance in disease of coconuts since, so long as a pathogen confines itself to the roots, it is possible for the palm to go on replacing affected roots, provided that environmental conditions are favourable for its growth. In addition to this factor, it has been stated that the number of roots formed by a coconut palm is considerably in excess of the number required at any one time. It is obvious therefore that in normal healthy palms a root fungus may be established for a considerable time before the gradual reduction in vitality becomes apparent in symptoms of deterioration and ultimate death. In this connection it has been recorded that root disease sometimes takes ten years to kill a palm. On the other hand, if the organism attacking the roots penetrates into and kills the tissue of butt or bole of the palm, more rapid death follows owing to the stoppage of the supply of water and dissolved salts from the soil.

It is convenient to consider the two forms of disease separately and they may be differentiated by the terms " root disease " and " butt disease;" the distinction is arbitrary since a root disease may also become a butt disease and, again, the presence of a condition of root disease may be the predisposing factor for the development of butt disease. Root disease is slow in action, whereas butt disease may be rapid.

Root Disease.—The external symptoms of root disease are those of slow degeneration. The outer leaves wither and droop and often remain for a long time suspended round the stem. The yield drops owing to the suppression of the flowering branches and the fall of immature nuts. New leaves become successively smaller and smaller and the stem tapers at the top, with the result that the crown eventually consists of a few small, erect and yellowish leaves on a tapered stem. In extreme cases the leaves all wither and the bud decays. This final decay of the bud must not be confused with bud-rot caused by a species of *Phytophthora* in which the bud decays first. The main characteristic of root disease is its slow action and the symptoms described are typical of what is known as tapering or wasting disease of coconuts. In this connection it may be stated that through the kind agency of the superintendent of an estate in the Negombo district records of the yields, etc. of a number of trees affected with tapering disease are being kept in order to obtain definite data on the rate of progress of the disease.

There are a number of conditions besides fungus infection of the roots which may induce the symptoms described. Unfavourable soil conditions or conditions which tend to cut down the

supply of water from the soil may result in the display of one or more of the symptoms enumerated above. A brief review of some of these conditions will not be out of place here.

Drought.—The results of drought are well known; wilting and hanging down of the outer leaves and the fall of immature nuts are common effects. Recovery usually occurs with the resumption of suitable weather conditions.

Flooding.—Constant flooding or planting in badly drained or swampy soil may cause typical tapering symptoms. Roots of the coconut are unable to take up water in the absence of air and the water-logging of soil sets up anaerobic conditions which render the soil unfavourable for growth. Tapering of the stems is common among palms planted under such conditions and it is illuminating to see such areas after draining and to observe the increase in girth and the general improvement in the appearance of the palms.

Old Age.—It is well known that coconuts lose productivity and display symptoms of degeneration after a certain age, probably as the cumulative result of a number of conditions, including the decrease of resistance to disease.

Soil Conditions.—This heading includes a number of factors which may induce tapering, and for convenience it may be considered in two sub-sections, conditions which are rendered unfavourable by

(a) the presence of an inhibiting factor, and

(b) the absence or insufficiency of a soil constituent essential for normal growth.

(a) Inhibiting factors are of two kinds, physical and chemical. Under the former may be included the " hard pan " formation in some of the soils in Ceylon. The presence of a hard pan at a certain depth below the surface renders the palms more susceptible to drought and results in symptoms of tapering; this problem is cultural and need not be considered here. Land which is liable to be inundated by sea-water may become impregnated with salt with the result that the palms fail to develop normally, and may therefore be classed in the group in which a chemical inhibiting factor is present. Another example is to be found when a definitely toxic substance occurs naturally in the soil, but fortunately this appears to be rare in Ceylon. In addition to these, excessive acidity or alkalinity of the soil may induce conditions resulting in tapering.

(b) Tapering symptoms induced by the absence or insufficiency of essential soil constituents rarely occur on well-cultivated land. In the Eastern Province, a very sandy soil markedly deficient in humus, which deficiency is sometimes aggravated by

excessive ploughing, has been observed to give rise to tapering symptoms in a considerable area of coconuts. A deficiency of mineral constituents such as lime, phosphorus, nitrogen or potash (which will be mentioned again later) may cause a similar degeneration.

The conditions briefly reviewed above are of such a nature that they cause a number of trees to be affected in a given area, but it should be borne in mind that such conditions, if present in a small degree only, may cause a decrease of resistance to disease, which may be confined to certain trees only and therefore appear only sporadically through such an area.

Fungus Disease.—*Rhizoctonia bataticola* has been found on dead roots of palms which displayed symptoms of tapering in a number of districts in Ceylon and it is probable that further investigation will reveal its presence everywhere. It has been found on dead roots in a variety of soils and under a variety of conditions. There has been some discussion as to its significance in roots of woody plants, particularly of tea and rubber, and the recent discovery of its presence in apparently healthy roots of tea (reported in the *T.A.*, *March*) has indicated the possibility of its almost ubiquitous presence in tea as a common mycorrhizal fungus, i.e., a fungus living as a symbiont in normal healthy tea roots in a manner somewhat analogous to the root-nodule bacteria of legumes. It is possible that the possession of mycorrhiza by plants may be of mutual benefit in that the plant supplies the fungus with carbohydrates while the fungus, being able to utilise sources of nitrogen in the soil which are not available to the host plant, supplies the host with combined nitrogen. The condition, however, is essentially one of suppressed parasitism, and the fungus is broken down and absorbed by the host plant in the inner cells of the cortex. So long as the host cells retain this power of resisting the fungus and of keeping it under control it is conceivable that the absorption of the fungus material will be of value to the host plant by supplying readily available combined nitrogen. If the resisting power of the plant be reduced, a different set of conditions arises enabling the fungus to proceed in the manner of a normal parasite, killing the cells in its advance.

A mycorrhizal fungus has been seen in the small roots of the coconut; it has been shown that normal coconut roots may contain a mycorrhizal fungus and it is but a short stage to infer that the hyphae present in healthy roots may be those of *Rhizoctonia bataticola* which hyphae produce sclerotia when some condition arises to cause the death of the root. In other words, it is suggested that *Rhizoctonia bataticola* is a mycorrhizal fungus of coconut as well as of tea. If this assumption is correct then it is obvious that conditions which upset the balance between root

and fungus are of primary importance and an investigation of these conditions essential. Potash deficiency has been proved to be a predisposing factor in the incidence of a disease of jute caused by *Rhizoctonia bataticola* in India and an experiment has been started on a coconut estate in the Negombo district to test if the addition of (a) potash, (b) lime, or (c) potash and lime will have an ameliorating influence on the progress of tapering disease. An experiment of this kind is speculative and serves to indicate how little we know of the physiology of the coconut palm and to emphasise the need of a full study of the conditions which affect its growth favourably or unfavourably.

At the same time, it is possible that *Rhizoctonia bataticola* is a parasite of the normal type and preliminary inoculation experiments have been set up to determine this point. No positive results have been obtained as yet and it will be necessary to carry out inoculations under varying conditions before a definite statement can be made as to the pathogenicity of the fungus towards coconut.

In addition to *Rhizoctonia bataticola*, other fungi have been isolated from the roots of palms which displayed the symptoms of tapering. Pure cultures of these fungi have been grown and inoculation experiments are in hand to determine if they are parasitic or whether they merely live saprophytically on dead roots. It is probable that *Fomes lucidus* and *Poria Ravenalae*, fructifications of which are common on decaying coconut wood, are among the fungi isolated. Fungi of this type, if parasitic, are likely to pass into the bole of the palm, since they are essentially wood-rotting fungi, and to cause what has been termed butt-disease which probably brings on a more rapid death of the palm than root disease alone. Further investigation is necessary to determine the conditions, if any, which enable these fungi to attack the palm and to deduce therefrom satisfactory methods of control.

A general review of root disease, to use the term in its narrow sense, tends to indicate that external conditions play a large part in the appearance of the symptoms of slow degeneration which characterise the disease and may themselves be the only operating factor. In Ceylon we have but touched the fringe of the problem, but it would appear that, if in the case of the coconut palm, the external conditions are favourable, the danger of root disease is minimised. This is amply borne out by the relatively small amount of disease that occurs on estates that are well and wisely cultivated.

Butt Disease.—This form of disease is comparatively rare in Ceylon and, during the time in which special attention has been given to the study of root disease of coconuts, no cases definitely attributable to this type of disease have been encountered. Petch

has recorded the occurrence of this form of root disease caused by *Fomes lucidus*. Death follows rapidly after the entry of a parasite into the bole or butt of the palm, since the hyphae enter and fill the conducting vessels of the vascular strands and cause what is known in herbaceous plants as a wilt, and eventually rot the tissues. Under certain conditions it may be possible for fungi of this type to spread from tree to tree, and the removal and burning of diseased tissue is advocated. We know very little of the conditions, if any, which enable the fungus to attack the palm, but it would appear that certain conditions are necessary since the fungus *Fomes lucidus* is common in coconut land whereas disease caused by this fungus appears to be of rare occurrence. This emphasises the point mentioned before which is that the preliminary investigations into the problem of root disease of coconuts have indicated the need for a full investigation into the conditions, particularly those of the soil, which affect the coconut palm favourably or unfavourably.

Discussion.

His Excellency the Governor.—We are very much obliged to Mr. Park for his interesting paper. There are many members in this Conference who know a great deal about coconuts. I hope they will take part in the discussion and give the Conference the benefit of their experience.

Mr. Wanigasekere said that he was struck by a remark made by Mr. Park that one of the factors which led to root diseases in coconuts was the deficiency of Phosphoric Acid and Potash in soils. He (the speaker) had examined a large number of soils and had noticed that most of the coconut soils in Ceylon were deficient in Phosphoric Acid and also deficient in nitrogen and organic matter. Although it had been stated by some gentlemen who were interested in tea that soil analyses were not useful in solving agricultural problems, he had found that soil analyses were helpful.

Mr. Park stated that in the experiments he had carried out in the Negombo District for controlling the disease, he must admit that he did not include phosphoric acid. He had used potash, potash and lime, and lime alone, and he had found that the palms so treated had improved. But there was no doubt that the experiments could be extended to include heavy doses of phosphoric acid. He (the speaker) was, however, not concerned with the chemical side.

His Excellency suggested that Mr. A. W. R. Joachim might give them his opinion in the matter.

Mr. A. W. R. Joachim stated that there was no doubt that Ceylon soils were generally deficient in Phosphoric Acid. That was an established fact. Soil analysis had established that beyond doubt, and if it had done nothing else, it had shown one important point of the soil problem in Ceylon. As they all knew, any plant needed a certain amount of each of the more important fertilizing constituents, viz: nitrogen, phosphoric acid and potash. If the soil was deficient in any of those constituents, the increase in the yield was bound to be limited.

Continuing the speaker said that all coconut mixtures contained an excess of phosphoric acid, as that was necessary for fruit production.

Mr. Wace De Neise.—May I ask Mr. Park why he states that the absence of humus in the Eastern Province soils is aggravated by ploughing ? My own experience is that ploughing was beneficial.

MR. PARK said that he had seen the condition in one estate in the Eastern Province. There heavy ploughing was undertaken with the result that humus was used up.

MR. STOCKDALE said that he knew the particular area which Mr. Park alluded to. There intensive ploughing had been undertaken and now that estate had found it necessary completely to change its system.

MUDALIYAR RAJAPAKSE thought that if ploughing was done once in two years or once a year, it would be quite sufficient.

MR. G. ROBERT DE ZOYSA agreed with what Mudaliyar Rajapakse had stated on the matter.

MR. C. N. E. J. DE MEL said that he had been asked whether a lack of certain constituent in the soil, such as phosphoric acid was directly responsible for root disease. There was divergence of opinion on that subject of root disease. About two years ago a certain planter who was greatly alarmed in seeing a number of trees tapering off brought the matter to his notice, and since then they had made observations, and lately Mr. Park had taken up the subject, and he (the speaker) could say at the moment that it was not right to run away with the idea that it was due to a lack of any constituent in the soil. From his experience he could put down the tapering of trees to other causes than root disease. It was sometimes due to pure neglect and hard soil.

DR. SMALL stated that the investigation of tapering disease was still in its infancy and it was too premature to arrive at any conclusions. It would, however, lead to a line of work that would have important results for the coconut industry. The solution of that matter in his opinion was the early establishment of the Coconut Research Scheme in which in the midst of coconut districts, chemists, mycologists and entomologists could work together. The Mycological Division of the Department of Agriculture at Peradeniya, was doing its best but their efforts in that particular direction of coconut root disease was necessarily limited.

MR. STOCKDALE.—With regard to the discussion generally, I would like to mention that this investigation is still in its preliminary stage. What we do ask is that coconut estate owners and others, when they find definite signs of diseases should communicate with us with regard to those diseases. Then it will be possible to make further headway with the work which has been started. As regards the question of ploughing, I do not think I need go into that in detail. The question of ploughing coconuts as for any other crop depends entirely upon the conditions prevailing, and the owner or occupier of the land must use his agricultural sense. Agriculture is, after all, an art, and unless the owner or occupier of the land has any agricultural sense, sound practice cannot result. He might plough once a month or once a year; everything depended on the soil and climatic conditions. Everyone must use his common sense in dealing with practical agricultural operations.

HIS EXCELLENCY.—Ladies and gentlemen, we have had a very interesting discussion which I am sure will be helpful and instructive to many of us engaged in this very important industry.

HIS EXCELLENCY then called upon Mr. G. Robert De Zoysa to read his paper entitled "The Marketing of Produce."

The Marketing of Produce.

G. ROBERT DE ZOYSA.

THE successful marketing of produce is a subject which requires a considerable amount of thought, judgment, and careful study of the conditions prevailing, the requirements and satisfaction of wants of people in various parts of the world. Therefore, in order to get a close understanding of the subject one is obliged to refer to a few popular principles of economics especially in relation to demand, supply and value as affecting markets.

Cournot says:—" A market is not merely a place in which things are bought and sold but the whole of any region in which buyers and sellers are in such free intercourse with one another that the prices of the same goods tend to equality easily and quickly."

The central position of a market is the public exchange where traders agree to meet and transact business. Traders may be spread over a whole region and yet make a market by means of meetings, published price lists, the post-office, and telegraphic communications.

The important markets for Ceylon produce are:—London, Liverpool, New York, Hamburg, Antwerp, Oslo, Melbourne, Syndey, Kobe, Genoa, Barcelona, Cape Town, Alexandria, and one or two other places.

The elasticity of wants:—Every step in the progress of man increases the variety of his needs together with the variety in his methods of satisfying them. He desires not merely larger quantities of the things he has been accustomed to consume but better qualities of those things: he desires a greater choice of things and things that will satisfy new wants growing up in him; also there is a constant increase both in variety and expensiveness which custom requires as a minimum and in that which it tolerates as a maximum. In view of this it is essential for the producer to study the requirements of the consumer from all points, and what articles will satisfy his cravings because the general conditions of life are not stationary. When a person's demand for anything increases he will buy more of it than he would before at the same price, and that he will buy as much of it as before at a higher price. A general increase in his demand is an increase throughout the whole list of prices at which he is willing to purchase different amounts of it and not merely that he is willing to buy more of it at the current prices. The demand of a single individual, for

such a thing as tea, is fairly representative of the general demand of a whole market, because the demand for tea is a constant one; and since it can be purchased in small quantities, every variation in its price is likely to affect the amount which he will buy. In large markets where rich and poor, old and young, persons of all varieties and tastes, temperaments, and occupations are mingled together the peculiarities in the wants of individuals will compensate one another in a comparatively regular gradation of total demand. Every fall however slight in the price of a commodity in general use, will, other things being equal, increase the total sales of it. And therefore if we had the requisite knowledge we could make a list of prices at which each amount of it could find purchasers in a given place during say a year.

The total demand in the place for tea is the sum of the demands of all the individuals. Some will be richer, and some poorer than a particular individual who is willing to buy at a rupee a pound—say 10 lb. in the year. The difference between the satisfaction which he will get from buying 9 lb. and 10 lb. is enough for him to be willing to pay one rupee for it; while the fact that he does not buy an eleventh pound, shows that he does not think that it will be worth an extra rupee to him: that is, a rupee a lb. measures the utility to him of tea; it measures the marginal utility to him and one rupee per pound is the marginal demand price. Let us suppose that there are a million purchasers in the place, and the average consumption is equal to his at each price. Then the demand of this place is represented by the same list of prices as before if we write million pounds of tea instead of one lb.

The Law of demand.—The greater the amount to be sold the smaller must be the price at which it is offered in order that it may find purchasers; in other words the amount demanded increase with a fall in price, and diminishes with a rise in price.

The theory of buying and selling becomes much more complex when we take account of the dependance of marginal utility on amount in the case of money as well as of the commodity itself.

Nearly all dealings in commodities that are not very perishable are affected by calculations of the future relation of production and consumption. Some of the dealings in "futures" are but incidents in speculative manouvres, but in the main they are governed by calculations of the world's consumption on the one hand, and the existing stocks and coming harvests on the other. Dealers take account of the areas under cultivation with each kind of produce, of the forwardness and quantity of the crops, of the supply of things which can be used as substitutes and of things for which these crops can be used as substitutes. If it is thought that the growers of any kind of produce in any part of the world

have been losing money and are likely to cultivate a lesser area for a future harvest it is argued that prices are likely to rise as soon as that harvest comes into sight. Anticipations of that in turn influence cash prices: the reverse of this condition is illustrated in the present state of the rubber market.

The circumstances which govern the price for any given commodity vary in character from one problem to another; but in every case the more of a thing is offered for sale in a market the lower is the price at which it will find purchasers. The general circumstances of the market will remain unchanged until there is a change in fashion or taste and new inventions to increase the demand.

The conditions of normal supply vary in detail with the length of the period of time to which the investigations refer. The demand and supply schedules do not in practice remain unchanged for a long time together, but are constantly being changed; and every change in them alters the equilibrium amount, and the equilibrium price, and thus gives new positions to the centres about which the amount and the price tend to ossilate. These considerations point to the great importance of the element of time in relation to demand and supply. In an age of rapid change such as this the equilibrium of normal demand and supply does not correspond to any distinct relation of a certain aggregate of pleasures got from the consumption of the commodity and an aggregate of the efforts and sacrifices involved in producing it. The fact that the general conditions of life are not stationary is the source of the difficulties that are met with in applying economic doctrines to practical problems.

The purchasing power of money is continually changing and rendering necessary a correction of results obtained on our assumption that money retains a uniform value. This difficulty can be overcome fairly well since we can ascertain with tolerable accuracy the broader changes in the purchasing power of money. Causes of alternating periods of inflation and depression of commercial activities are intimately connected with those variations in the real rate of interest which are caused by changes in the purchasing power of money. Since money is a general purchasing medium and there are likely to be many dealers who can conveniently take in or give out large supplies of it; this tends to steady the market.

Mill observed, " What constitutes the means of payment for commodities is simply commodities. Each person's means of paying for the production of other people consist of those which he himself possesses. All sellers are inevitably buyers."

When confidence has been shaken by failures, capital cannot be got to start new companies or extend old ones; and there is

little occupation in any of the trades which make fixed capital. Those whose skill and capital are specialized in these trades are earning litle and buy little, and therefore buying little of the produce of other trades. Other trades finding a poor market for their goods produce less; they earn less and therefore they buy less. The dimunition of the demand for their wares makes them demand less of other trades. The disorganization of one trade throws out of gear others and they react on it and increase its disorganization. The chief cause of the evil is want of confidence, the greater part of it could be removed almost in an instant if confidence could return, touch all industries with her magic wand and make them continue their production and their demand for the wares of others. Confidence by growing would cause itself to grow; credit would give increased means of purchase and thus prices would recover.

The keynotes in the establishment of sound markets of modern movement are:—

(1) The diminution of friction of every kind which might hinder agencies from combining their action and spreading their influence over vast areas.

(2) The development of transport by new methods and new forces.

(3) The cheapening of transport, communication by land and sea, by printing press, telegraph, and telephone.

(4) The breaking up of cartels, combines and monopolies, and

(5) The most important of all, Stability of Exchange and facilities rendered by the Banks.

In practice it is often difficult to ascertain how far the movements of supply and demand in any one place are influenced by those in another. The general tendency of the improved methods of communication is to extend the area over which such influences act, and to increase their force. The whole of the Western world may be regarded, in a sense, as one market for many kinds of stock securities for the more valuable metals and gems, and the raw material produced in the east; power allowances being made for expenses of transport and taxes levied by customs houses through which the goods have to pass. In all these instances the expenses of transport will not be sufficient to prevent buyers from all parts of the Western world from competing with one another for the same supplies.

There are many special causes which may widen or narrow the market of any particular commodity: but nearly all those things for which there is a very wide market are in universal demand, and capable of being exactly and easily described, so

that they can be bought and sold by persons at a distance from one another, and also from the commodities. If necessary samples can be taken of them which are " truly representative:" and they can be even carefully "graded" by an independent authority, so that the purchaser may be secure as to what he buys will come up to a given standard, though he has never seen a sample of the goods which he is willing to buy, and perhaps would not be able to perform an opinion if he did. This has even led to international speculative combines in produce markets and stock exchanges.

Commodities for which there is a very wide market must also be such as will bear a long carriage: they must be somewhat durable, and their value must be considerable in proportion to their bulk. A thing which is so bulky that its price is necessarily raised very much when it is sold far away from the place in which it is produced, must as a rule have a narrow market.

The Great European War and the disorganized state of affairs which followed it marked an important epoch in the history of all the world's markets. The demand for commodities varied continuously from day to day within wide limits. Now there was a boom for a special type of goods, and the next moment saw the slump. No one was sure as to what would happen from day to day. The frequent fluctuations in the exchange and the big drop in value of currency units made it almost impossible for there to be any stability in all European markets for the produce of this country.

The produce of this country at present except for the plumbago and gem industries is agricultural. The finding of profitable and extensive markets for the disposal of the raw material of the island, and the growing of new crops to meet the requirements of the different markets all over the world is an important factor in the economic development and prosperity of the country.

Owing to the ever increasing competition among producing countries the present tendency of buyers to form cartels and combines which is a real menace to all producers, and thereby making it increasingly difficult for producers to dispose of their goods profitably calls for special organization, and immediate action. In this connection the Government appointed a commision, in which I served, to report upon the advisability of appointing commissioners to find new markets for Ceylon produce, and to stimulate the export trade of Ceylon. The report has been submitted to Government, and it is hoped that the recommendations made would be acceptable.

In view of what has already been laid down the following suggestions will help considerably in establishing a regular and firm market for the produce of this country:—

(1) High standard for quality.

(2) Careful " grading " and good packing, keeping bulk always up to sample.

(3) Carefully organized propaganda.

(4) Services of trade commissioners in important markets to collect information regarding the requirements of consumers as to variety and quality of goods. Type of packages; explore fresh markets, and assist in every way in stimulating and developing our trade, and also look after the propaganda work.

(5) The establishment of a trade bureau and commercial museums in Colombo and London for a start.

(6) Careful control of the cost of production. The high prices realised at any one time should in no way tend to throw up the cost of production, because a " boom " is a very temporary state of affairs.

In conclusion I wish to briefly touch upon the general conditions which have influenced the marketing of the staple products of this country. It is outside the scope of this paper for me to make a through analysis of the situations at the different periods and demonstrate how the principles I placed before you bear upon them, nor will the time and place permit such a discussion. All of us here are only too familiar with the three chief marketable products of this country, namely: the produce of the coconut palm, tea and rubber.

Coconuts.—Copra is now looked upon as the most important manufactured product of the coconut palm. The industry suffered very much during the years of the Great War; mainly because Germany was the chief consumer until that time. There was a boom in the year 1919-20 the price rising to Rs. 130·00 per candy in October of 1920. This was owing to the very strong demand for fats immediately after the war. Copra prices are comparatively low owing to the somewhat disorganied state of affairs amongst producers, imperfect knowledge of the requirements of consumers, crude methods of manufacture, want of uniformly high standard of quality, regular public sales as in the case of tea and rubber.

Owing to the entire absence of propaganda and skilful advertisement of the produce of the coconut palm, the market for the commodities are restricted and not what they should be.

The palm produce for the discussion in hand may conveniently be divided as follows:—

(1) Copra

(2) Coconut Oil

(3) Desiccated nut

(4) Coir fibre

(5) Poonac

Obviously in view of the fact that Desiccated nut, Coconut oil, and Copra constitute raw material for articles of food there should be a better demand at higher prices. What is urgently required is a system of carefully organized propaganda; the various markets should be probed and the commodities presented in a judicious manner, with the help of the services of experts. The method of manufacture of the articles should be improved upon where possible both in regard to quality and efficiency. Investigations made as regards the most convenient shape, size, and form of packages, which again should be as attractive as possible, and at the same time be useful to the consumers.

The near markets should be worked up to introduce nut owing to its bulk, limited keeping qualities, and difficult transport. The antipathy of nearly half the population of India for animal fats and the nature of their diets should help the export of large quantities of nut to that country if the proposition is skilfully handled.

If the whole population of India could be worked up to consume more coconuts, the entire crop of this country will not be sufficient to meet the demand. Our crop for the year approximates 1620 million nuts. If the average individual demand as the result of the general use of nuts work out at 10 per head for a month, then the total demand of the entire population for a year will be in the neighbourhood of 3600 million nuts.

The publication of carefully and correctly written literature on the use of the commodities in a variety of ways for the preparation of food, etc., will tend to increase the consumption. Thus for example, the preparation of a curry in European countries is very expensive owing to the high cost of the chief ingredient, namely the juice of the coconut expressed from the fresh nuts sold in those markets. I am sure there are very few even in this audience, who are aware of the fact that desiccated nut gives very satisfactory results in this instance, and the method is quite simple. An aliquot quantity of D/C moistened with hot-water, crushed and then pressed will give the required " Coconut milk " at a much cheaper price.

Tea.—The Tea Industry has established a strong market for itself by rigidly adhering to a high standard of quality, careful grading, active propaganda and regular public sales. There is now a constant demand and a strong market for all classes of tea at very attractive prices. This is a very good case to illustrate the advantages derived by resorting to organized methods of marketing produce.

Rubber.—The rubber market has had a very erratic record; there have been booms and slumps at various times. The critical slump occurred in 1920, when the market quoted average prices absurdly under the cost of production. The economic crisis was believed to be the result of over-production, accumulation of stocks of manufactured articles, limited use in rbuber goods, general trade depressions, and world-wide financial puzzles. The compulsary restriction introduced in November of 1922 eased the situation and eventually a boom was experienced in 1924-25. Normal restriction has helped in several cases to completely re-organize declining markets for various commodities at different times. Rubber restriction failed owing to the fact that one section of growers continued to extend their areas and to produce at high tension resorting to scientific investigation for increased crop production, whilst the other section adopted drastic reduction of even their normal supply. Obviously the present crisis was inevitable. The one solution is reduction in cost of production in every conceivable way and invention of new channels for consumtion of the commodity. Another factor which tended to seriously interfere with the industry was the formation of vicious cartels and combines.

Discussion.

His Excellency the Governor said that they were all thankful to Mr. De Zoysa for the interesting paper he had read. The author of that paper had dealt with two aspects of the question referring in particular to the subject of internal markets. He would say that that was a subject of real importance for the small producer in the country. There was not very much use in asking the village cultivator to produce more food, if they could not make it possible for him to sell his surplus produce at a reasonable profit. In order that he might do that, some system of marketing should be established.

With regard to the question of external markets, he (the speaker) was glad that Mr. De Zoysa had called attention to two important points, the chief of which was that of grading. It was a very important matter. It was very necessary that the person who bought Ceylon tea knew that he was getting a good article. He believed that in the tea industry this was done, although at times they heard the complaint of rubbishy teas, and that sometimes good tea was mixed up with leaf that did not find its origin in the tea bush. That was a very bad practice, as the reputation of a product was of great importance to the whole Island, and he hoped that it would be possible by some means to ensure that tea shipped from Ceylon was of good quality and that there were no complants. The same remark also applied to rubber, and as a matter of fact to all produce shipped from the Island. Government would do all it can to help in this direction. He would mention that in South

Africa where the export of fruit was becoming an important industry, the industry itself undertook grading, and fruit was exported under certificate from the graders. In like manner all maize exported was graded and similarly was cotton.

Continuing His Excellency said with regard to the question of advertising, referred to by Mr. De Zoyza, that he was not sure whether Ceylon was doing all it ought to do in that connection. All who knew Europe would know that Ceylon tea was hardly distinguished as such in the minds of the consumer. China tea was known as also Indian tea. When Ceylon tea was mentioned the impression was that it was a kind of Indian tea. Ceylon was not getting the full benefit of the reputation it could and ought to establish in Europe, and other countries. He thought it would be advisable for those engaged in that important industry to pay more attention to the question of advertising as it was one of considerable importance. One had often heard of the great potential markets for Ceylon tea in the Continent of America. At present America was a great coffee consuming country, but it was said that the American consumer could be made to consume anything put before him if it were sufficiently advertised. Advertising in that direction would pay and it would bring to the consumer the advantage and benefits of tea drinking. In that way it was possible to open up markets into which they had not yet penetrated. He hoped that that matter would receive due attention from those concerned.

Mr. Stockdale said that the matter of marketing of village produce required very close and careful investigation. He thought that it would be a mistake to start off by assuming that one could assist the village cultivator in any area in the disposal of his crop by putting down a market there or by making arrangements for transporting his goods. They knew very scantily and very sketchily the way in which village produce found its way to the markets. They knew, for instance, that there were itinerating middlemen who went round purchasing crops. At a previous Conference some facts were given in regard to the disposal of produce in the Central Province and the Kegalle District, and it was stated that arecanut crops were sold before they had set on the tree. There existed a condition of gamble and the middleman took his chance, and he took it at a price which was beneficial to himself. The result was the village cultivator received a very small share of the real value of the crop, and it was perfectly obvious that if means could be devised by which the villager could put that crop in the open market, he would receive a higher price. That was more or less the case with all commodities produced by the village cultivator. In regard to paddy there were certain well defined exporting areas in the Island. For instance, the Eastern Province exported a fair amount of its crops to Jaffna. Similarly Tissamaharama and Hambantota exported its paddy to the Matara District. One knew perfectly well that as soon as the crop was harvested it was disposed of to dealers. If ways and means could be devised whereby those crops could be held up till prices hardened, it would considerably benefit the producer. It had been urged that the provision of stores was necessary. It ought to be realized that to simply set in and put in a number of stores would be risky until one knew the exact form of storage which would be the best suited. In the case of perishables the position was still more difficult. It was urged that there should be better transport facilities, but he felt most strongly that there were many areas in which the provision of a larger number of markets would be of great benefit to the village grower. They had already established a number of markets in centres from where food supplies were obtainable. In the North-Western Province there had sprung up a large number of village markets to which producers took their crops, but he did not think that Ceylon was sufficiently covered with markets. Improvement in this direction was a matter for close investigation.

In conclusion Mr. Stockdale said.—" There is little doubt that we can produce a very much larger supply of our food and currystuffs, but I do feel that we will not make headway until we can settle the question of the disposal of that produce and the establishment of a chain of markets. The present distribution of imported goods is well organized and it will be necessary to be able to meet the competition of that organization. I have indicated to you the difficulies that we are up against. I do not pretend that I have any solution for the problem. I only think that the problem is one which requires careful investigation from the beginning."

MUDALIYAR RAJAPAKSE said that he must contradict the statement made by Mr. De Zoysa with regard to the quality of copra, namely that it was due to the producer. It was not so. It was the fault of the merchant who did not encourage the production of a better quality by paying more for the better grades. He appealed to Government to intervene and stop merchants exporting a quality of copra which should not leave the Island.

MR. DE ZOYSA said that if producers got together they could get the merchants to come to them on bended knees. He regretted that Mudaliyar Rajapakse was one of those who did not encourage the establishment of local sales by which not only the quality but the price would have very much improved. The market was in their hands but the producers did not encourage them. They had taken up the matter with the Chamber of Commerce and there was to be another meeting next Tuesday.

MUDALIYAR RAJAPAKSE said that he did not agree, because an inferior quality of copra not sufficiently dried was exported. During the War there was not sufficient freight and everybody produced very good copra.

HIS EXCELLENCY.—We will leave this question to be settled elsewhere and come to the subject of the paper which I find is the marketing of produce.

MR. A. GODAMUNE said that the peasant required the greatest assistance in the matter of the marketing of produce. In the past Ceylon had a system of bartering. The system of marketing was entirely new to the villager, and he was very often hoodwinked by middlemen. He (the speaker) suggested that the system of marketing of produce might be met in the same way as co-operative dairying which Mr. Brayne had suggested. They might be able, if they did not advance further, at least to study the problem in all its aspects from the villager's point of view.

MR. C. V. BRAYNE said that he had studied the system of co-operative marketing with great interest for some time and it seemed an extraordinarily difficult problem. In his own opinion the ultimate solution was the establishment of a system of co-operative markets as Mr. Godamune had suggested. He sought some information on the subject in London recently while on leave to work out a system of co-operative marketing of paddy for the Eastern Province. However, the expert opinion on the subject was that co-operative marketing was a very difficult thing, and was a further advance on co-operative credit, and the co-operative experts were rather afraid of going too quickly.

With regard to marketing generally, he (the speaker) appreciated what the Director of Agriculture stated that they had not sufficient data of the actual state of the problem, and he wondered whether it would not be possible to detail a man with the necessary training to give his whole time to the village marketing problem. Personally he would welcome the appointment of such an officer in the Agricultural Department.

HIS EXCELLENCY said that they had a very interesting discussion. He understood that the Director was proposing to submit certain proposals with regard to Marketing. He thought that they had to be a little cautious before they started co-operative marketing. There should be a sufficient number of men who understood the principles of marketing and business

principles to run a co-operative marketing management successfully. It did require expert knowledge and he was not sure whether they had in the villages sufficient number of people who were able to work such a system of marketing. Without saying that co-operative marketing should be left out of consideration, he would say that he was not convinced that the time had come for it and thus preserve an open mind.

His Excellency next called upon Mr. A. P. Goonatillake to read his paper on "Bee Culture."

Bee Culture.

A. P. GOONATILLAKE.

LET me in the first place offer you my sincere thanks for the privilege extended to me, to speak to you on the subject of bee-keeping; but my difficulty lies in the fact that the available literature on the subject does not apply to Ceylon conditions, the standard works on the subject having been written mainly for the benefit of American and European bee-keepers. You will therefore find that what I am going to lay before you to-day (except some theoretical facts) mostly consists of the results of experiments carried out in Ceylon.

Bee-keeping, as we understand it to-day, is a comparatively new industry, but in its crude form it goes back to the times of King Dharmasoka in the East, and Pliny, Ovid and Virgil in the West.

A few decades back, bee-keeping, as an industry, did not exist, but was carried on as a sideline. In America and some European countries, people took it up and to some extent developed it; but there were a few enthusiasts who foresaw its possibilities and worked at it with heart and soul. Though they were not able to produce honey on a commercial basis, yet the fact that it was produced in abundance and of good quality, was no doubt the chief reason for directing close attention to it.

Out of those crude beginings has sprung a well organized industry of vast economic value, providing a healthy and fascinating outlet for the energies of bee-keepers all over the world, offering employment to a large number of skilled labourers and producing increasing quantities of food of the highest value. Leaving aside the vast quantity of honey used for local sconsumption, America exports many tons annually, so does Europe, Australia and West Indies, but the exports from the latter countries are much less than the former. The quantities of honey imported by local firms, should, in the absence of any other incentive, encourage Ceylon bee-keepers.

In ancient times people got their honey from wild hives in the jungles. As time passed, they placed pots, hollowed logs and so forth in suitable places for the bees to occupy. Still later, when it was found that bees were attracted by sweet smells, they resorted to rubbing and fumigating such receptacles with sweet smelling substances, and placing them in convenient positions to be colonised by stray swarms. Under this crude system, no one was able to keep a definite number of hives, nor was it possible to prevent the bees from quitting the hives, after the combs were removed. It was impossible to get the honey free from brood and pollen, and also to examine and see what was going on inside the hive. In recovering the honey it was usual to burn the whole swarm with a torch, or to smoke out the bees with sulphur, or again make use of irritating substances like pepper and chillies to drive them away. But if bees are kept according to modern methods, one may have any number of hives, provided the hives are ready and swarms available. Again, one may remove combs from a hive without disturbing the bees, since such combs can be taken out one by one and examined, or removed, and honey can be secured free from brood and pollen: and all without the risk of being stung.

In more recent times (some 50 years ago) an attempt to carry on bee-keeping on modern lines was made by the late Mudaliyar Jayatillake, W. H. Wright, J. Holloway and Chas Andree, but their efforts did not encourage the general public to follow their example. About 30 years ago Mr. Mathew Shanks of the Master Attendant's Department, being an ardent enthusiast, who was ready to instruct others in the art, made a beginning with apiculture on scientific lines. As a result, within a very short time, there sprang up quite a number of bee-keepers, a few of whom formed themselves into a committee (known as the Bee-Committee) affiliated to the Ceylon Agricultural Society. Within the last 10 or 15 years, bee-keeping has made such strides in Ceylon, that it has proved a blessing to the villagers in some parts of the country, while its success is a matter for much gratification to those who tried to encourage the industry. We are thus much indebted to Mr. Shanks in particular and to the other members of the Bee-Committee of whom I would specially mention Mr. C. Drieberg, who spared no pains in bringing the Ceylon Bee-keepers' Association into being, and acted as its Secretary. But I am sorry to say that with the retirement of Mr. Drieberg, the Association has not functioned as it should have done, and I would, therefore, appeal to the Director of Agriculture to put new life into it.

When I speak to you on bee-keeping, as an industry or a hobby, some of you may say, that it is a most dangerous and risky pursuit; but I can assure you, that after you gain experience

in handling bees, you yourself will say that it is one of the most pleasant and interesing occupations one can think of. To begin with, you may wear a bee-veil and a pair of gloves, but as you gain experience you will put them aside as too cumbersome.

In colonising a box-hive, if a stray swarm cannot be captured, find a wild hive, intimidate the bees by puffing smoke from a smoker, and cut out the combs and place them in a basket. After every bit of comb is removed, allow the bees to rest a while and cluster together. (Once the combs are removed the bees are less inclined to sting.) After about 15 minutes, give them another puff of smoke and watch for the queen. The moment she comes on the surface of the swarm, pick her up by one wing, with fore finger and thumb and clip the other wing. In performing this delicate operation, one should be careful not to injure any part of her body. While she is being held, she will naturally be restive and try to free herself, therefore clipping should be done very carefully. After this, move the prepared hive close to the swarm and place the queen with a few attendant bees on the top of the frames of the hive. If you find the queen running about on the frames, introduce some more bees, and in a short time all the bees will come and cluster round her. Then close the hive and remove it the same day, after dusk, to where it is to be kept. Keep a close watch on the newly-colonised hive for four or five days, for they may attempt to escape; but after you find brood or even eggs in the new combs, you can give them entire freedom and they will hive contentedly. Once brood is established in the hive, the bees will never quit it, unless they are rudely disturbed. In absconding from a hive, the queen frequently falls on the ground in her attempt to fly, and will be found running about near the hive till she is discovered by the bees. Therefore in approaching such a hive care should be taken not to tread on the queen.

Once the hive is colonised, the bees will start building their combs, but if " comb-foundation " is given them, they will be greatly assisted in their work. Combs should be built perpendicularly downwards from the centre of the top bar of the frame, and must never be allowed to be built criss-cross, so that the frames become attached to one another. When the hive is almost full, remove the top cover, place a "queen excluder," and on top of this a " Super " (or upper storey) containing frames for storing honey. But if the hive is to produce " comb-honey " a super fitted with sections may be given even without the queen excluder.

In most parts of Ceylon, there are two seasons in the year, in which one can extract honey, that is:—February-March and July-August. *Apis Indica* (the Ceylon bee) swarms only during, or a little before, the first honey-flow, and never during the July-August flow. Consequently, we get a very little surplus honey

during the first flow; unless of course, we take the precaution to prevent swarming in time. If the honey-flow and the working capacity of the hive are good, one may be able to put on an additional super, or even more than one, as occasion arises. When the honey is ripe and sealed over, the combs should be removed and the honey extracted, or if comb-honey is being produced, remove and keep the combs away from the bees until disposed of. In Ceylon the honey seasons may alter with unusual changes of climatic conditions.

The modern honey extractor renders it possible, not only to extract honey faster and untouched by hand, but also to save time and labour in the building of comb; for, when the honey is extracted, by centrifugal force, the comb comes back emptied and undamaged, so that it can be returned to the bees immediately after extracting, to be refilled. Besides, with the extractor, there is the possibility of extracting more than once during a good honey-flow. For instance, if the flow runs incessantly for over four weeks, there would be the possibility of extracting honey twice; and if it is prolonged for say six weeks, three times, and so on. It takes 10 to 15 pounds of consumed honey to build one pound of comb.

I might here explain how honey can be removed almost without the knowledge of the bees. An American, named Porter, was the inventor of a simple device, called the " bee-escape." When there is ripe honey in a super, lift the super, remove the queen-excluder (if there be one) and replace it by the escape board. If this is done in the evening, say about 5 or 5-30 p.m. it will be found next day at about 8 a.m. that the super is practically empty of bees. If there are a few bees left, they can be blown or brushed off and the combs removed. The secret in this simple device is, that whilst the bees are able to go out, they are unable to come in again.

I would like to make it quite clear how honey can be got free from brood and pollen. To do this,the lower hive or the brood chamber must be reserved for breeding, and the queen confined in it. This is accomplished by using the " queen-excluder " a perforated zinc sheet, through which the queen cannot pass. This is placed between the brood-chamber and super. I have stated before that if a hive is run for comb-honey, with supers containing sections, a queen-excluder need not be used. This is because, though the queen has access to the super, she is unable to lay in them, since the thickness of the comb, and the separators inserted between every row of sections, prevent the queen from raising her head, whilst her ovipositor is inside the cell, an attitude necessary to the laying of eggs.

Let me now say something as to the relation of apiculture to agriculture. It is a well known fact that in the vegetable kingdom, there are male flowers and female flowers, as well as flowers in which both sexes are present, and that unless pollen is applied to the pistil, a flower will never set fruit. In assisting fertilisation, bees are of the greatest help, and so of immense importance to the agriculturist and horticulturist.

I would here like to quote a few passages from the works of well known writers. John Wright the famous horticulturist in his prize essay, on " Profitable fruit growing," writes, under the heading Bees and Fruit:—" Since the last edition of the Essay was published, much attention has been given to the importance of associating varieties of fruit, and particularly apples, the pollen of which helps each other. Generally speaking, it is considered that there should be one row of the complementary variety, to four of the stock variety, because, then the whole five become thoroughly fertilised. As examples of happy associations, I may mention the following, Victoria with Grenadier; Worcester Pearmain with Cox's Orange Pippin; Worcester Pearmain with Charles Ross; Bramley's Seedling with Newton Wonder. Every apple mentioned is a valuable one in itself, and each variety is improved by the companionship of the other. In this matter, it is of course, important to associate varieties, the flowering season of which is the same, and which are liberal producers of pollen. With a suitable association of varieties, bees will do the rest."

H. H. Thomas (Editor of " Popular Gardening ") in his " Fruit growing for Amateurs " states:—" Nature has various agents for pollenizing fruit flowers, but of these bees are far the most important, because, unlike other insects, they carry the pollen from flower to flower and tree to tree, whereas the various flies, wasps, etc., are unable to do so to any appreciable extent. These latter may, indeed, help in pollenzing self-sterile blooms by shaking off the pollen, just as a camel-hair paint brush might do. Wind has no great pollen distributing and carrying power."

In " Hardy Fruit Culture " by Charles F. Lawrance, F.R.H.S., the author, referring to imperfect pollination, says:—" Many varieties of apples, pears and plums are self-sterile, which means, that they require pollen from another variety to set the blossoms. Fruit is usually lacking when Cox's Orange (apple) or William's Bonchretien (pear) are planted in isolated positions, with no varieties in the immediate vicinity, both being self-sterile. Regular crops of fruit may be obtained by planting certain varieties somewhere near the sterile trees. Bramley's Seedling (apple) will give excellent results with "Cox's Orange" and Fertility (pear) will provide pollen for the " Bonchretien." Strange to say, the pollen of the latter although useless in its own

case will set the blossoms and give good fruit on " Fertility." Many other instances of this peculiar fact might be given, but space is limited. Fruit growers will realise how necessary bees are in orchards and plantations. Amateurs, possessing only a few trees, could make the pollination of self-sterile kinds certain with a rabbit's tail tied to a stick, carrying the right pollen in this way to the blossoms which need it."

In his " The Bee-keeper and the Fruit grower and why and how their interests are mutual " Mr. E. R. Root, the world famous American authority on bees, writes:—" It has now become demonstrated, that many kinds of fruits, if not all kinds, are greatly benefitted by the bees, and that, a large portion of our fruit, such as the apple, pear and particularly the plum, would be barren, were it not for the helpful work of the honey bee. This discovery is largely owing to the discovery of Professor Waite of the Agricultural Department at Washington."

Again, in another place he says:—" In those great green houses near Boston, where early cucumbers are grown, it is always necessary to have one or two hives of bees inside, to fertilise the flowers. No bees, no cucumbers; unless men go round with a brush and dust the pollen from one flower to another."

And, again he says:—" We can easily forgive the bee his short working days, when we consider the good he does. There is no question about the debt fruit growers owe him. People talk about the wind and other insects in fertilising our flowers, but I am confident, that any man who will really take the time and pains to investigate for himself, will see that the bee is nearly the whole story. I have seen the certain results of his good work in a neighbour's orchard. Those bees " broke the trees down " just as truly as though they had climbed on the trees by the million and pulled at them. The appearance of those trees after a few years of bee-keeping would have convinced any fair minded man that our little buzzing friends are true partners of the fruit grower."

I might quote many more passages on this subject from well known authorities all over the world, but I fear I shall be taxing your patience. I should here like to quote a local case in point. When a Mora tree was about to flower, all its branches but two were lopped off, leaving one on either side of the tree. One of these two was covered with a mosquito net just before the flowers opened. When the two branches were in full bloom, it was observed, that the covered branch was visited by two varieties of ants only, whilst the uncovered branch was visited by numberless bees. After flowering had ceased, the net was removed; and the ultimate result was that the covered branch bore a very small crop, while the uncovered branch was heavily laden.

Some people say that coconut flowers are not fertilised by bees, but if you take the trouble to observe you will see hundreds of bees working on them. Personally I am confident that the bees go a long way to help the coconut planter in pollinating the flowers.

In conclusion, I should like to say that, notwithstanding the progress bee-keeping as a home-industry has made, it is still in its infancy; yet I feel sure that in due course, every one who grows crops for fruit or seed, will find it necsesary to keep bees; and, for this reason the agriculturist and horticulturist, as well as the market-gardener, should acquaint themselves with the principles of apiculture and train themselves in the handling of bees.

Discussion.

His Excellency said that they were all grateful to Mr. Goonatillake for that delightful paper on a delightful subject. Mr. Goonetillake, as they all knew, was an enthusiast in the art of bee-keeping and it was generally recognized that he knew more about bee-keeping than any one else in the Island. He (the speaker) did not know anything about bee-keeping except on several occasions he had encounters with them and it was the bee that died. In his travels in the Island he often tasted the wild honey. It was pleasant to the taste, but the honey served to him invariably contained fragments of defunct bees. The method advocated by Mr. Goonatillake removed that. He understood that bees were a valuable adjunct in connection with the propagation of plants, and therefore, the industry was one that was worthy of encouragement.

Mr. Wace De Niese said that he was sure that Mr. Stockdale would be good enough to exploit that aspect of bee-keeping in relation to coconut cultivation and the pollenising of coconut flowers, in spite of the fact that that Conference had charged him with so many different activities. Mr. Stockdale was the most hard working Director the Agricultural Department ever had. He was a most lovable man and sympathized with the needs of the people.

Mr. Robert De Zoysa.—May I enquire from a business point of view whether Mr. Goonatillake could give us some statistics of the amount of honey that could be obtained from a hive, etc.

Mr Goonatillake stated that it was possible to get 10 bottles of honey per hive every season. There were two seasons in the year.

Mr. De Zoysa.—What is the cost of a hive ?

Mr. Goonatillake.—About Rs. 15·00 if made in teak.

Mr. De Zoysa.—What is the actual cost of getting the honey ? I mean cost of coolies, etc.

Mr. Goonatillake said that it was not advisable to entrust that work to coolies. They ought to do it themselves.

Sir Solomon Dias Bandaranayake.—I should like to put one or two questions to Mr. Goonatillake. I wish to know whether Italian bees have been introduced into this country, and if so, how they compare with the local bees as regards honey producing capacity and the ease with which they could be handled. The other question is whether rubber flowers have the effect of giving a bitter taste to the honey gathered from them.

Mr. Goonatillake said that they had Italian bees, but he did not think they had done anything appreciable. He thought that Cyprian bees did better than any other kind of foreign bees. As regards honey gathering capacity, he thought that the Cyprian bees would beat even the local bees. With regard to the bitter taste produced in honey, he (the speaker) did not think it was due to the rubber flowers, but was due to a variety of flowers known as *Walhinguru.*

Sir Solomon did not agree with what Mr. Goonatillake said about the bitter taste.

Mr. Stockdale said that immediately after rubber flowering, one found a bitter taste in honey. Similarly a bitter taste was produced from the manioc flower. But he was not prepared to say that he had traced the bees to those particular flowers and he could not say that there was any connection between the two.

In conclusion Mr. Stockdale added.—" Mr. De Niese has asked about the question of the pollination of the coconut flower. I think it is generally accepted that the coconut flower is mainly wind pollinated, but I am not prepared at this stage to say that bees could not have some influence in the pollination of coconut; I ask you however to accept this statement with reserve.

His Excellency again thanked Mr. Goonatillake for his very interesting paper.

Thursday, May 10, Afternoon Session.

His Excellency the Governor requested Mr. W. P. A. Cooke to read his paper entitled "The development of the Wanni from the point of view of the people of Jaffna."

The Development of the Wanni from the Point of View of the People of Jaffna.

W. P. A. COOKE, M.Sc.

Divisional Agricultural Officer, Northern.

Introduction.—The development of the Wanni has engaged the attention of successive revenue officers from the time of Mr. Dyke and that of the Government for the last 50 years, particularly after 1903 when the Northern Railway was opened. With its opening it was expected that the enterprising and industrious cultivators of the Jaffna peninsula would move on to the Wanni and bring it under cultivation. Although it is 25 years since the opening of the railway, the enterprising and industrious cultivator of the Peninsula has not moved on to the Wanni to settle down or to cultivate in increasing numbers. In this paper I take liberty to present the situation from the stand-point of the Jaffna people. In doing so, it is necessary to give an idea of conditions that prevail at present to enable you to follow my suggestions which will be presented in the latter part of my paper. At this stage it is

necessary to explain the term "Wanni" and give its location. Mr. Lewis in his *Manual of the Vanni* states that several derivations are suggested; and they are that it refers to forest, intense heat, scarcity and, according to the Tamil histories, the district took its name from the Vanniyas of India who colonized it. The area is the tableland of Vavuniya with an elevation of 200 to 300 feet sloping Westward and Eastward to the sea. The Southern boundary is now moved into the North-Central Province. Some state that it comprises the whole of the North-Central Province including Tamankadduwa district, portions of Puttalam district, portions of Batticaloa and Trincomalee districts, portions of Uva Province, portions of the Jaffna district and nearly the whole of the Mannar and Mullaitivu districts. For the purpose of this paper I shall confine myself to the Mannar and Mullaitivu districts and the Karachchi and Punakeri divisions of the Jaffna district.

The area and population of the divisions of Jaffna and the Wanni:—The area of the Jaffna district is 999 square miles and it contains a population of 374,800. The area of the Mannar district is 964 square miles and the population is 25,582. The area of the Mullaitivu district is 1,466 square miles and the population is 18,706. I shall now express the number of acres per head of population. Jaffna division including the Urban District Council area is 1/5 of an acre; Valigamam West $\frac{1}{2}$ an acre; Valigamam North a little less that $\frac{1}{2}$ an acre; Valigamam East 1 acre; Vadamarachy 1 acre; Tenmarachy $1\frac{1}{2}$ acres; Islands 1 acre; Delft $2\frac{3}{4}$ acres; Pachilapalli 8 acres; Karachchi 33 acres and Punakeri 47 acres. Mannar gives 24 acres. If Mannar Island and two coast fishing villages of Vangalai and Vidataltivu are excluded, the rest of Mannar will not show marked difference to the rest of the Wanni in regard to acreage per head of population. The above figures indicate the pressure of population in the Jaffna peninsula, particularly in the Western and Central portions and the Islands. It also indicates the large area of land available for cultivators in the mainland of the Northern Province.

Climate:—The whole area receives its water supply from the North-East Monsoon during October, November, December and January. The rainfall is greater towards the South and decreases towards North but the lowest fall is along the West coast. The rainfall on the west of the Jaffna-Kandy road varies from 20 to 40 inches and east of the road varies from 40 to 60 inches. The patch that receives the greatest fall is round Nedunkeni which is about 5 miles south of Oddisudden and midway between Mullaitivu and Puliankulam which is on the 125th mile post on the Jaffna-Kandy road. The rainfall here varies from 75 to 100 inches. The Jaffna Peninsula is coastal in character but the atmosphere is comparatively dry. The dewy season lasts about a month till the end of

January. The Western coast of the mainland and the Mannar Island have the same climate as the Peninsula but the rainfall is less. The Wanni receives a little more rain and the atmosphere is comparatively more humid and warmer. The dewy season is longer in the Wanni and lasts till the end of March. The daily range in temperature in Jaffna is 8·5 but in the Wanni it is 15·6. It will be seen from the above figures that the climate in Jaffna is comparatively pleasanter and less rigorous than the Wanni climate.

Land values, interest rates and labour supply:—The average price per acre of dwelling site in the western portion of the Peninsula is Rs. 8,000·00. Paddy land Rs. 4,000·00, and tobacco land Rs. 3,000·00. In the eastern part of the Peninsula the price per acre of any land varies from Rs. 25·00 to Rs. 5,000·00. The value of land in the Wanni varies from Rs. 50·00 to Rs. 200·00 for cultivated paddy lands. The value of coconut lands in full bearing at Veddukadu in the Punakeri division goes up to Rs. 500·00 per acre. The rate of interest on loans in the Western portion of the Peninsula is 6 to 7% on secured debt and 8% on promissory notes. In the central portion of Jaffna the rate is 9% on mortgage and 12% on promissory notes. In the eastern portion of Jaffna the rate is 12% on mortgage and 18% on promissory notes. The interest rate in the Wanni varies from 18% on mortgage to 40% on promissory notes. The average wages in the Peninsula for ordinary labour is 75 cents and in the Wanni it is a rupee. Labour is scarce in the Wanni, and the supply comes from Jaffna for seasonal work.

Soil characteristics, their relation to agriculture and character of the people.—The soils in Jaffna may be divided into three classes. (1) The lime soil area which may be termed the "warm" soil. Here the water supply is high being about 10 to 15 feet from the surface. This type of soil is found in Valigamam West division and the Islands and in patches in the other divisions of the Western and Central portion of the Peninsula. The cultivation in this area is paddy, chillies, garden crops and a small quantity of tobacco. (2) The second class of soil is the red soil. The watertable is about 30 feet from the surface. The water supply is more than ample for purposes of cultivation. The principal crop of this area is tobacco and garden crops. This area is in the central portion of the Peninsula. The elevation is higher than the lime area. (3) The third class is the sandy soil of the eastern portion of Jaffna. For the sake of comparison this may be termed the "cold" soil area. The principal crop of this area is coconut and a small quantity of tobacco and paddy is grown. Cultivation in this area is very difficult owing to its sandy nature. It is interesting to note that the "warm" soil area with its facilities for cultivation was the first to be developed. The red soil

area which is intermediate in character but supplied copious underground water supply was the next area to be developed. The cold soil area which presents difficulties for cultivation was the last to be developed. In this area the development process is still going on.

The soil in the Wanni is hard in texture and is difficult to cultivate. The water supply is from tanks which are fed by the North-East rain. Wells are difficult to sink, watertable being low and the water itself is not wholesome. The tank water is uncertain, consequently the cultivation is uncertain. The only crop cultivated in this area is paddy. There are occasions when chena cultivation is practised but not to a great extent. We have heard a great many statements made against this wasteful method of cultivation. It is undoubtedly the least exacting of all cultivations but it is the unfortunate lot of the chena cultivator that he never had or has a chance to ventilate his difficulties in person nor is his intelligence and knowledge sufficient to present his case. In his defence it must be said that with his empty purse, lack of the necessary advanced implements, and agency to supply powerful traction, permanent cultivation of chena land is an impossibility. The ground is hard, the grass grows quickly, the stumps are to be extracted and well has to be sunk to supply water. He requires capital to uproot and level the land and to sink a well. He requires iron ploughs and big animals to pull them. One can well imagine whether these are within reach of the Wanni villager who sees money only on occasions. At present however Government is sympathetic towards the chena cultivator and grants him land sufficient to meet his food requirements.

The influence of the type of agriculture on the character of the people.—To restate the type of agriculture there are four types to be found. (1) The " warm " soil area of the west of the Peninsula with facilities for easy cultivation having paddy, vegetables and tobacco as the main crops. (2) The Red soil area of central Jaffna with deep wells having plenty of underground supply of fresh water and affording facilities to cultivate crops of high value such as tobacco and chillie. (3) The eastern " cold " sandy soil area of Jaffna suitable for coconut and tobacco where hand watering is required owing to the porous nature of the soil causing difficulty in cultivation. (4) The Wanni area where paddy is grown under tanks and occasional cultivation of chena.

1. The Western area of Jaffna, as stated before, was the first to be developed. Consequently the density of population as a section is greatest here. Educational institutions were first established in this area where emigration to Colombo and to the Federated Malay States originated and eminent men in public life, professional, business and Government service sprang up. Lands

are owned by this class of people and cultivated by hired labour and to a very small extent the lands are leased on fixed rental. The people here own land for the sake of status. It is a matter of little concern for them whether the paddy crop pays or does not pay. The people depend on India for food supply.

2. The central area is the red soil area, here the remunerative nature of agriculture is the highest averaging as much as a thousand rupees per acre. The result is the people are engaged in cultivation, emigration is less, population is dense and severity of toil is great but is followed by deserving returns which make it worth while to toil. It may be correctly stated that the cultivators here live on their well-sweeps.

3. The eastern section of the people are comparatively poor. The land does not give a good return and the cultivation is both exhaustive and unremunerative. Owing to the porous nature of the soil hand watering is resorted to. Here it is a case of maximum toil and minimum return. The result is less food supply, impaired vitality and prevalence of malaria. A good number of them are employed as labourers in coconut estates. Coconut being an unremunerative proposition in this area, wages are low. There is very little education, and majority of people though landowners prefer to sell their labour. The population is sparse in this area as is to be expected.

4. The Wanni area. Here I should like to relate an incident which happened during Mr. Dyke's time as related by the late Mr. Asaipillai who was the mail contractor between Jaffna and Matale for a considerable time. Mr. Dyke was attempting to colonize the area under Kalawewa with the Jaffna people. He took several families and all of them died leaving a few families. Mr. Asaipillai was asked to bring another lot of colonists. They were duly taken and, at meeting these families, both parties celebrated a funeral in true Jaffna fashion instead of rejoicing. The moral is that people in the Wanni feel that they are entire slaves to circumstances.

> " His life is a long drawn question
> Between a crop and a crop "

He beholds the sky for the rain to fill the tank and looks to the field for grain. He is chronically indebted to the " Kadai Keeper " and the Jaffna trader. He is this year a land-lord and the next year a tenant. During cultivation time he lives in the watch hut and during off season be does " Rajakaria." "Rajakaria" is work done for the State such as contribution of share of his work in repair of tanks, keeping the jungle round his village clean, clearing a certain length of jungle road, putting up temporary buildings such as schools or visiting dispensaries, etc.

His attention is directed towards three things in life. (1) To his cultivation. (2) The money lender and (3) The Chief headman. Of late there has been some improvement in this condition due to opening up of communication, the sympathetic treatment by and close contact of revenue officers and to a small extent the supply of credit through Co-operative societies.

The conditions which are prevailing at present in regard to movement of Jaffna people to the Wanni.—Having given a picture of the agricultural conditions and characters of people in the areas under consideration one has to look to the natural forces which are in operation in this area in regard to Wanni development. The greatest factor visible is the Geographical influence. In order to realise this, one has to look at the map and find out how the Peninsula is placed in relation to the mainland. The Peninsula is fifty miles long and about 15 miles broad. It runs almost West to East. The portion east of Chavagachcheri-Point Pedro road is directly north of the mainland, and the western portion projects into the sea westward and is north of the Mannar Island. Owing to natural facilities of communication, the people from Vadamarachchy, i.e., from Karaveddy, Udupiddy and Puloli parishes go to the Trincomalee and Batticaloa districts by boats. After the opening of railway and the Karachchi scheme they have divided their attentions between Karachchi and the Eastern Province. The people from the western section centre their attention to Punakeri and Mannar districts. The Northern Railway and the Jaffna-Kandy road have brought facilities for the Tenmarachy and Pachilapaly labour to move freely to Karachchi, Mullaitivu and Vavunniya. The land-lords of Valigamam North through which the railyway runs up to Kankesanturai are the people to go in for the Karachchi lands. The Railway and the Jaffna-Kandy road owing to the Geographical situation have not yet drawn the land-lord class of the western section to the Wanni to a desirable extent. The land-lord class from the Jaffna town and the Jaffna Maniagar's division has opened up considerable areas under paddy and coconut in the Punakeri division. The cattle from Jaffna are driven to pasture in Punakeri. Here I shall give the distances involved in travelling to the different parts of the Wanni. The distance from Jaffna to Punakeri by boat is 16 miles; from Punakeri to Mannar is 50 miles; from Jaffna to Tunukai section *via* Punakeri is 40 miles; from Jaffna *via* Punakeri to Mannar is 68 miles; and from Jaffna *via* Punakeri to Giant's tank area is 75 miles. Let us compare these distances with the Wanni in Karachchi, Mullaitivu and Vavunniya districts. Jaffna to Kilinochy is 43 miles, Jaffna to Kilinochy *via* Punakeri is 33 miles, a difference of 10 miles in favour of Punakeri route. Jaffna to Mankulam is 60 miles. Jaffna to Vavunniya or Mullaitivu town is 90 miles. Jaffna to Mannar *via* Vavunniya and

Parayanalankulam is 137 miles. Jaffna to Giant's tank area by the same route is 135 miles. It is needless to say that the opening of the railway to the East does not facilitate traffic between Jaffna and the Trincomalee by district. The distance to Trincomalee by train is the same as from Jaffna to Colombo and takes twice the time.

Artificial colonization vs. Natural colonization.—With these facts placed before us we are prepared to consider suggestions that will help to encourage the development of the Wanni by the Jaffna people. Before doing so it is necessary to touch on the two systems usually spoken of in colonization. I refer to the artificial colonization and the natural colonization. In regard to the artificial colonization I have referred to before, the incident that took place during Mr. Dyke's time in connection with the Kalawewa area is significant. During recent times the Nachadua colonization scheme proved a failure. Let us for a moment examine the status of a would-be colonist, who would be approached for artificial colonization. He would be undoubtedly a man owning no land and no money. He would be one who has had very little managerial ability or experience. The State will be burdened with an expensive organization to recruit colonists and finance them till a return is forthcoming. This is not all. The settlement officer ought to possess a knowledge of farm management and production economics. Many workers in land settlement emphasize the importance of farms being organized on the basis of best combinations of enterprises and the most economical combinations of capital, land, area and labour. These qualifications required of a colonization officer indicate that the-would-be settler ought to have sufficient intelligence to back him to maintain himself as a land owner. All men are not born to be proprietors. At least a good proportion of the present generation of the peasantry is destined to be either labourers or tenants. It is easier for the State and desirable from the standpoint of the peasant to let him make his own choice. But it is the duty of the State, however, to provide facilities to encourage the movement of the people in directions indicated by facts. Before proceeding to the next topic of my paper it is necessary to state that a tenant in Jaffna enjoys privileges which it is difficult to improve on. The rental is fixed and the extra profits earned as a result of manuring, better tillage and other improvements go to the tenant. The tenant has all the inducements to do intensive cultivation.

Suggestions that will help to encourage the development of Wanni by the Jaffna people.—Before launching out on a scheme of development it is necessary to make sure of the opportune moment suitable for development. We have to examine the problems confronting the minds of the people of Jaffna at any given time when development schemes are provided. In this

connection I may quote the Director of Agriculture who sums up the situation thus:—" There is no doubt in my mind that the pressure of population in the Peninsula of Jaffna is so great that the emigration in increasing numbers will become annually necessary. In the past this pressure of population has been relieved by the demands of the clerical services and by the opportunities in the Federated Malay States. With increasing competition in these spheres the youth of Jaffna is finding his opportunities becoming more and more restricted and he will be obliged by economic forces to turn more and more to agriculture. It may be urged that this class of youth will not gladly turn to agriculture, but I feel that if systems of land tenure in the Wanni were made suitable for this class, development would take place." I have indicated in the second part of my paper that the western and central section of the Peninsula are over-crowded. In consideration of the movement of the people I have indicated it will be noted that no competition exists in regard to movements. People of different sections of Jaffna move to different sections of the Wanni. I have indicated that the construction of the Trincomalee railway does not assist movement to that district, and we find that the section which moved to Trincomalee is moving to the Karachchi area under the Iranamadu tank. Further it may be stated that the Batticaloa district is brought nearer to Jaffna by the Batticaloa railway. It is now left for me to say to what part of the Wanni we must look for development and how best the State could give the necessary encouragement.

Agricultural possibilities.—Let us examine the agricultural possibilities afforded in the Wanni.

Coconuts.—The coast area in the Punakeri division and the Mullaitivu district form good lands for coconuts. Development in this direction is taking place slowly.

Paddy.—Most parts of the Wanni are suitable for paddy but the difficulty experienced is in regard to irrigation facilities. Owing to the hard nature of the soil paddy cultivation without irrigation is impossible.

Garden crops.—The area round Nedunkeni is excellent for tobacco, orange, lime, pineapple, plantain and chillie. Natural and gradual development is taking place in this area.

Cotton.—The area round Tunukai resembles the black cotton soils of India. This is estimated at 16 square miles or 10,000 acres of such lands. This area is good for cotton, tobacco and other rotation crops. Thus it will be seen that the Wanni is suitable for coconut, paddy, garden crops, tobacco and cotton. It may be asked as to why development has not taken place from the Peninsula which carries an excess of population. For the answer we have

to refer to the Geographical situation of the congested area in relation to facilities of communication to the Wanni. The congested area is the central and western Jaffna and the Islands and for communications these parts are not linked up with the Wanni. To the Westerner the Wanni is in the farthest wilds infested with wild animals and malaria. This means that the communication facilities are not provided for the natural overflow of the excess population. It must be stated however that development is taking place against odds.

Nedunkeni area.—Rapid development will take place round the Nedunkeni area from the central and eastern section of Jaffna with a little financial assistance from the Government to sink wells. The holdings should be under 5 acres and a development loan of Rs. 500·00 to each unit would be sufficient to get the development started. If the loans are given after a careful inspection of land by an agriculturally trained officer the success of establishing a local development would be an easy matter. I say this with confidence as I know that the crops grown in this area are highly remunerative and the land will pay its development cost within about 5 years. This is an area admirably suited for small holdings.

Paddy area.—In regard to development in the paddy area there are two directions in which this development is taking place. One is the Karachchi section under the Iranamadu Scheme and the other is the Punakeri section. In regard to the Karachchi scheme, I have stated before that the capitalists are drawn from Valigamam North through which the railway passes to Kankesanturai and the labour comes from the eastern section and the Vadamaradchi area near Point Pedro. Unfortunately for this scheme the saying "It takes two crops of settlers to make the third stick" is applicable. The people had no experience of the system of cultivation to be adopted and had to do pioneer work. The cultivation methods are now becoming systematized and fair returns will be secured. The slow development in this area is now due to the poor nature of the soil and lack of capital. In regard to advancing capital I am not bold to recommend it as I do in the case of Nedunkeni. It is a question which will have to be considered on the income of the individual concerned from outside sources. The paddy land under Karachchi will not give a margin of profit for its development rapidly enough. The slow game practised by the people not to hasten development by investing large sums to uproot stumps and level the land appears to be a sound proposition. If loans are granted they have to be secured by hypothecation of property outside the Karachchi and considered along with

the applicant's monthly income. There are a few other reasons for delay in development which are now subjects under correspondence between the farmers and the Government Agent and in due course these defects will be rectified.

The second area where development in regard to paddy is taking place is Punakeri. The natural overflow is bound to take place here from the Jaffna division, western section and the Islands. The chief difficulty is communication. The approach is now by boats which at times, is impossible to cross.

The most pressing need of the Peninsula from an agricultural standpoint is the construction of the Kerativu causeway. The construction of this causeway ought to receive priority of consideration over all other developments. In spite of the difficulties of communication considerable areas of paddy and coconuts are brought under cultivation. There are still large areas awaiting development. In this section financial aid is not of primary consideration. With the construction of the causeway and metalling of the roads from Punakeri to Mannar, Mankulam-Tunukai-Vellankulam road and Paranthan to Punakeri developments will take place in the areas mentioned above for paddy, coconuts and cotton rotation crops. In this area there are a number of breached tanks chief among which are the Akiankulam, Vannerikulam, Vavunikulam and Kurai tank. These suggestions for consideration in the immediate future I do not claim that I am the first to submit. These proposals in different forms from different sources have come up for consideration from Mr. Dyke's time.

1. The construction of the proposed Kerativu causeway appears to be the most urgent need of the Peninsula. This will bring the Wanni to the very door of the people who most require an outlet for the excess population.

2. The Nedunkeni section where crops of a highly remunerative character are cultivated and is suitable for small holdings. Financial assistance to sink wells will convert a fairly large area into a prosperous colony.

3. The Karachchi scheme is under consideration by the Government Agent and it is safe to leave the matter in his hands.

4. The area near and about Tunukai covers very rich soil but has to wait the development of Punakeri but the three roads from Punakeri to Mannar, Mankulam and Paranthan require metalling. The real Wanni begins from the Tunukai area. Man has to use scientific devises to conquer the real Wanni. Deep borings have to be undertaken to ensure unfailing water supply. Introductions of implements to tackle the hard soil is essential. Supply of credit is required to sink wells and buy machinery.

Discussion.

His Excellency said that they were very much indebted to Mr. Cooke for his exceedingly instructive paper. It was fortunate for them to have Mr. Cooke with them at the Conference. He (the speaker) had had the advantage of seeing something of his work and of seeing for himself something of the esteem and confidence that Mr. Cooke enjoyed among the people with whom he was working. He thought that it was fortunate for the Department of Agriculture to be represented in the Northern Division by so capable and sympathetic an officer as Mr. Cooke. He had given them much food for thought in his paper. It had dealt with a problem of great importance and also of great difficulty. The Government was interested in the problem, and some of the suggestions that he had made were under consideration by the Government. He (the speaker) did not want to say very much about the causeway. It was a scheme which he was very anxious to see proceeded with. The Government could not act in the matter without the co-operation of the Legislature, and he hoped that all the difficulties confronting the project would be overcome. He had no fear, however, that if a really economic scheme could be developed, the necessary financial provision would be forthcoming. He had had the advantage of seeing something of the Karachchi Scheme, and the pleasure of discussing the scheme, and some of the difficulties to which settlers were exposed with a representative body of the settlers. As a result of their representations he hoped that measures would soon be taken which would relieve to some extent those difficulties and prove to the people of the Karachchi district that the Government had their interest at heart and was desirous of helping them to make good on the lands which they had taken up.

All of them who had visited the North must have been struck by the great difference in the appearance of the land from that in other parts of Ceylon, and must feel that here they were confronted with a problem that was different in kind almost from the problems to be met with in the Wet Zone. He did not suppose, however, that, in the course of a night or even a few months, they would discover a royal road towards the removal of the difficulties, but certainly the sympathy of the Government and of the country at large was with the dwellers of the Dry Zone.

One point had struck him in the course of his visit, and that was the absence of the windmill. He gathered that during a large portion of the year the North was favoured with consistently high winds, and it occurred to him that the windmill would be a real labour-saving device and a real help to the people. He did not know whether there was any snag about, but it certainly seemed curious that the windmill was not so popular in Ceylon as it was in other parts of the World.

Mr. A. N. Philbrick said that there was one point which seemed to him that Mr. Cooke did not refer to very fully and that was the question of health. He had not much knowledge of the country thereabouts, but shooting near Tunukkai and getting into conversation with the old keeper of the "madan" he had learnt from his informant that when the latter was a boy, the population of the village was about 50 or 60. On the occasion of his visit there were only eighteen persons, and, to the best of his recollection, only one child. Another village had the appearance of having been abandoned in the last five years, and yet another was populated by only one family. It seemed to him, as an outsider, that there could not be much use in getting people to migrate to these districts in the Dry Zone till health conditions were improved, for, he imagined that the cause of the very high mortality was malaria.

Mr. Cooke stated with regard to the suggestion of His Excellency about windmills, that the Director of Agriculture had for some time been studying the subject, but the difficulty in its way for the small farmer was the cost of the mill, as conceivably people who cultivated blocks of a quarter, half or three-quarters of an acre could not afford such a comparatively expensive auxiliary as a windmill. With regard to the decline in population, the theory he had put forward might not be the correct one and there might be some differences of opinion on it. His view of the matter was that the change of climate brought about a process of desiccation. Cultivation in the Wanni was not possible unless there was sufficient moisture, either in the form of rain or from the tanks. The failure of the rains resulted in a chain of consequences, involving the decline of cultivation, the decline in the food supply and finally in the decline of the population. The reason was often advanced that the cause of ill-health was malaria, but to this view he was not prepared to subscribe.

Mudaliyar Ramalingam congratulated Mr. Cooke on the instructive paper he had read. As His Excellency had rightly observed, Jaffna people should congratulate themselves in having an officer of the standard of Mr. Cooke among them. Mr. Cooke was trying to do his best for the Jaffna man, but as they all knew, the Jaffna cultivator was very conservative. He could not be easily induced to take up to modern methods of cultivation. The experimental station at Tinnevelly had been in existence for the past 16 or 18 years, but with all the labours of the Agricultural Officers it had not been possible to induce the Jaffna cultivator to change his methods. It was only in recent years through the exertions of Mr. Cooke that the tobacco cultivator had taken up to modern methods of cultivation. The Jaffna man failed to see the benefits of new methods. He did not agree with Mr. Cooke with regard to "rajakariar." "Rajakariar" was not labour done gratis for the State. He (the villager) repaired a portion of the tank, because he owned the land under the tanks. Unless the kept the tank in good repair, he would not find water to cultivate his land.

As regards the development of the Peninsula, Mr. Cooke stated that development was taking place. But he (the speaker) would say that development had taken place long ago in the Peninsula. Every inch of land in Jaffna had been cultivated, but nature was against them. This year the North-East Monsoon had failed and their crops too had failed. They therefore had to depend upon Burma for their rice and paddy.

He (the speaker) strongly supported the suggestion for the construction of the causeway at Keraitivu, a project which had been mooted years ago. A metalled road now ran to within three miles of the causeway. As a matter of fact, the project had been sanctioned during the regime of Sir William Manning, but with the construction of the agricultural road under the Karachchi scheme, it had been laid in abeyance.

With regard to windmills, he said that they were very costly, and moreover, he could give them instances where the windmill had failed. There was his friend, Dr. Paul, who introduced a windmill at very great cost. After some time it broke down and had not been repaired since.

Dr. Paul explained that the windmill he had installed was a very high one on the sea-coast. It had worked very satisfactorily for five years, but ultimately rust got into the mechanism and he could not persuade any workman to climb the dizzy height and repair the mill. That was the only reason why it had fallen into disuse. The cost was about Rs. 1,000, and he certainly thought, as His Excellency had stated, that it would be a very great boon to the cultivator because the expenses for its upkeep were practically nil. It would work for about 10 months in the year.

Mr. C. V. Brayne said that he would like to make a few remarks on Mr. Cooke's very interesting paper. There was, no doubt, that the population of Jaffna should have some scope for expansion, and the direction in which they could expand was Pooneryn and the Wanni. He had recently been to Pooneryn with the specific object of studying this particular question. He heartily agreed with Mr. Cooke as to the necessity for the Kerativu Causeway and declared that it was only a matter of foresight to prepare for expansion in that direction by constructing the causeway. What had hitherto militated against settlement was the absence of any easy channels of communication between the settlers and Jaffna to be made use of in cases of emergency. The speaker also advocated the extension of easy communication with Tunukkai and eventually with Mannar. Another imperative necessity in Pooneryn was a further irrigation scheme. On the occasion of a recent visit he had felt that the failure of acres and acres of paddy over which the cultivators had spent their time and money in manuring was enough to make one's heart bleed. Eventually the present Pooneryn fields could be converted into cattle pastures and the land under the tanks could be opened up in paddy. On the opposite side, there was no doubt that coconuts could be grown all the way to the coast. At present about 2,000 acres at the tail of the Peninsula were under coconuts, and this should develop as soon as means of communication were established.

With regard to climate, he (the speaker) said that the experience was as a country developed, the climate improved. No part of Ceylon had been conquered from the desert and from the forest without some amount of sacrifice in human life. It was the same story everywhere. For instance, Kalutara District was a very malarial district 20 years ago, but now there was no malaria at all.

With regard to "Rajakariar," Mr. Brayne endorsed what was said by the previous speaker. It was labour done for the benefit of the village.

Mr. Muttiah.—I have only one word to say, and that is, if Mr. De Mel had been here to-day, he would have been glad to hear that the people of Batticaloa have supplied the people of Jaffna with a good quantity of paddy and straw.

Mr. Muttuthamby said as regards the Wanni which belonged to Mannar and Mullaitivu Districts, he failed to see how any development could take place there until they had an efficient water supply. At present the rainfall was entirely undependable and the wells in that part of the country did not supply the amount of water which the Jaffna wells did. So far as the Wanni wells were concerned, the water was so inadequate that in some parts of the year the water was hardly sufficient for the domestic purposes of the inhabitants. Under those circumstances, he (the speaker) advocated the restoring of some of the ancient irrigation schemes.

Mr. Cooke thanked His Excellency and Mudaliyar Ramalingam for their complimentary remarks about him.

His Excellency the Governor thanked all those who took part in that interesting discussion.

His Excellency then requested the Hon. Mr. Stockdale to read his paper entitled "The economic development of the Dry Zones of the Island with special reference to the work of the Department of Agriculture on the rotation of crops."

The Economic Development of the Dry Zone of the Island.

F. A. STOCKDALE, C.B.E., M.A., F.L.S.,

Director of Agriculture.

AT the first Agricultural Conference held in 1926 attention was drawn to the necessity for investigations into the agricultural methods in the drier zones of the Colony and for a replacement of the chena system by a more systematic form of agriculture. I indicated that it was considered that a regular system of village agriculture could be introduced and that Ceylon could in the same way as India produce a vast amount of food stuffs by means of dry-land cultivation. It was also pointed out that rotation stations would be opened up, in order to test out what crops could be grown and to ascertain their correct place in the rotation.

In the present paper, I do not intend to deal with such questions as the improvement of irrigation facilities and the further extension of irrigation works in the Dry Zone, but to limit myself to dry land cultivation, to some of its problems and to make special reference to the work of the Department of Agriculture on the rotation of crops.

The first consideration that was given in dealing with this problem was whether any permanent crops could be established on a successful scale.

The first crop that suggested itself was sisal, and in view of the successful growth of this plant at the old Mahailupalama Experiment Station it was thought that it offered certain possibilities and was worthy of close experimentation. It was known that sisal as a capitalists' crop could only be run successfully if large areas were opened up, in order that costly labour-saving machinery could be installed and kept fully supplied with leaves for treatment. But on the other hand there is in Manuritius a small man's fibre industry and every indication that sisal could be turned out in a similar manner as economically in Ceylon. The results of the trials made at the Anuradhapura Experiment Station have been issued in detail in Bulletin No. 81 and were sufficiently promising to warrant a further extension being undertaken. Government has recently sanctioned that two trials be made with the assistance of the Department—the one in the North-Central Province and the other in the Hambantota district. In these trials, the sisal will be planted by villagers on lands leased to them

on easy terms. Dry grain crops and gingelly will be taken off these lands during the first two years and then the sisal leaves will be supplied by the growers for cash to a factory which is to be erected in the village by Government and the cost of which will be refunded by instalments until the whole factory becomes the property of the village or some organization—such as a co-operative society—working in the village. A beginning has already been made at the village of Rambowa in the North-Central Province and the selection of a suitable locality is now under consideration in the Hambantota district. Throughout the undertakers will receive the assistance and guidance of Departmental officers, and the trials will show whether a village sisal industry is capable of establishment and development. The keenness of the villagers at Rambowa on this experiment is most encouraging and it is hoped that it will prove to be wholly successful.

Another crop of a more permanent character which gives promise of success is Kapok. Certain types of Java Kapok fetch higher prices in the markets than the local product. It is thought that these higher prices may be due to better drying and to better preparation and cleaning. Nevertheless, it was decided to make trials with imported Java seeds. The resultant crops have been sent to Europe for examination and report and the results showed that this product grown from Java seed did show certain superior qualities over the Ceylon product. Further seed will be secured and all the Ceylon grown seed from the Java kapok has been distributed. There is every indication that the cultivation of kapok as a money crop in the Dry Zone is worthy of extension. This plant produces its best crops in areas which are not too dry in the middle of the year. It grows well in the driest parts, but it does not crop so satisfactorily, as in those areas where the rainfall is somewhat higher. There is, however, no doubt that a greater production of kapok is possible and that great improvements in methods of cleaning the floss are necessary.

Another crop which has been tried in a comparatively dry area is citronella. In the Wewagam Pattu of the Eastern Province there are vast areas of talawas covered with a growth of mana. These areas run into several thousand acres, and it was at first thought that the grass was a wild citronella. Investigations were made and trials with true citronella grasses started. The wild grass is not likely to be of value for purposes of distillation, but on the other hand, the true citronella grasses have progressed most satisfactorily. A still has been erected and the first distillations of oil have been made. These oils are now under examination and if satisfactory the possible development of an industry for this poor section of the Batticaloa district is worthy of every encouragement.

It is not, however, in the direction of permanent crops that the greatest development is likely to occur. The growing of food crops in rotation with money crops is the development which it is to be looked for. In the previous paper it was indicated that amongst money crops the Ceylon cultivator would have cotton, ground nuts, tobacco and gingelly and amongst food crops hill paddy, maize, millets, kurakkan, green gram, cow peas, dhall and other pulses. For several years now small trial experiments have been carried out and from two rotation stations in the Hambantota district and from one station at Vavuniya data for two years are now available.

Cotton is a money crop which is suited to dry areas where the rainfall is satisfactorily regular, and does not become too heavy during those months which follow flowering. Our experience shows that cotton crops can be grown on quite a small rainfall if they are sown early, but that considerable flower and boll shedding takes place if heavy showers occur during the period of growth following flowering. The rainfall in Ceylon is irregular, as far as cotton is concerned and heavy showers of rain occur not uncommonly. During last year, when the season was a very wet one during the months of January to March much crop was lost and in Ceylon there is more to fear from rains during these months than from periods of drought. Cotton cultivation is in consequence likely to develop most in those districts which can be relied upon as being dry during the first three months of the year. It is more suited to development for instance in the Hambantota district of the Southern Province than in the North-Central Province, and good results have also been secured from some parts of Uva and from the Kolonna Korale of the Province of Sabaragamuwa. Yields have not been as heavy on the average as was anticipated. This is due to cotton having been grown on new lands, and to the consequent increased vegetative growth. In certain areas better crop yields have been secured in the second year of cultivation and it may be held in Ceylon that cotton rather tends to vegetative growth than to heavy fruiting. The problem for Ceylon is to cheapen the costs of cultivation and this is only likely to occur when greater use can be made of implements for ploughing, weeding, inter-cultivation, etc.

Ground-nuts have given heavy yields on some soils. On light sandy soils this crop is a most promising one, but it cannot be produced economically without the use of implements in the preparation of land and in lifting the crop. In Madras, the cultivation of ground-nuts is now in many parts replacing cotton and special bush types have been evolved for cultivation. In Ceylon field rats and wild pig are the greatest difficulty in regard to ground-nut cultivation. They cause very considerable damage. Losses from the former can be overcome or avoided, but losses

from the latter are not so easy to control. It must not, however, be overlooked that ground-nuts require particularly light soils for satisfactory cultivations and they cannot be recommended for growth except upon such soils.

Chillies have proved to be the most profitable crop and net profits of between Rs. 175·60 to Rs. 176·00 per acre have been secured. Higher profits are realized where parts if not the whole of the crop can be marketed green.

At Ambalantota, tomatos also thrive well and can be readily marketed. Profits of Rs. 70·00 per acre have been realized and can in good years be much higher. This is not a crop which can be grown in areas where transport facilities are not readily available, but experiments made this year indicate that satisfactory transport in small wooden cases is possible.

The trials with tobacco have not yet given results of any importance, but in view of the work on the cultivation of tobacco without irrigation on the Jaffna Experiment Station it is quite reasonable to suppose that good crops of tobacco can be grown without any resource to irrigation.

The trials with food grains such as kurakkan, millets, maize, etc., have shown that satisfactory crops can be raised. As equally good crops of these grains have been grown on land which has been continuously cropped as upon new chena lands. Cultivation prior to seeding is necessary in order to suppress weed growth and early sowing is desirable if the best results are to be secured. Green gram has done the best in the drier season, cow peas thrive well in all districts and form a most useful rotation crop for clearing land of weed growth. Its yields are not high, nor of high value. In wet seasons practically no seed is set but for ploughing in as a rotation crop it has proved most useful. Black gram and horse gram thrive satisfactorily and produce average crops. All the above crops have been grown satisfactorily on lands in rotation with cotton. The experiments with dhall have not yet yielded results which may be said to be conclusive. Crops have been poor and the correct season for sowing has not yet been definitely ascertained. On some stations the crops were ruined by attacks of the blister beetle (*Mylabris pustulata*) which cuts through into the flowers and prevents the fruit from bearing.

Fodder grass trials have been made. The kollupatti grass *Pennisetum cenchroides* has grown most luxuriantly at the Batata Station and *Paspalum commersoni* is quite promising. Sunn hemp has grown well and set good crops of seed and esperiments with fibre production have been carried out. Sweet potato crops and fruit plants are also growing satisfactorily. In brief the results obtained up to date are encouraging and there is little doubt

that a satisfactory system of agriculture could be evolved if holdings of adequate size could be made available to the holders. I am not prepared at this stage to dogmatise as to the exact size which would be necessary for an economic holding, but I feel that it will be between 15 and 20 acres. In the Hambantota district in one area the possibilities before the continuous cultivation of land has been seen by the villagers and they are sufficiently convinced as to enquire if they could not be given such lands for continuous cultivation. Areas have been leased to them for several years and they have cultivated them continuously with cotton and other crops indicated to them by officers of the Department. Similarly areas have been taken on lease in the Kolonna Korale for a continuous system of cultivation and have been culitvated in crops indicated by the Department. In this area plantains have been introduced and will probably be successful for the first two seasons.

Although the Department asked for five years before expressing a definite opinion, it is thought that a satisfactory system could be recommended for trial by Revenue officers. It is as follows:—

In leasing lands for chena or dry-grain cultivations provision for expansion and extension by the occupier should be kept in view. An ultimate expansion up to 20 acres (to include fodder for cattle and wood for fuel) is the minimum that should be aimed at for any holding. In the first year four acres could be allowed and in the second year an additional acre provided one acre of the first grant is properly stumped and similarly in the third and fourth year if one and a half acres are stumped annually. The lessee would then be in possession of 7 acres, four acres of which would be stumped and 3 acres in ordinary chena condition. In the fifth year cattle, ploughs and harrows would need to be acquired, and this could be accomplished if the lessees agreed that funds derived from cotton or other money crops were banked with some Government officer or co-operative organization against the provision of cattle and implements and additional financial assistance. In the Sudan systems of lease of lands require that one-third of the area shall be in cotton, one-third fallow and one-third in food crops. The whole of the food crops are the property of the lessee and one third of the cotton crop—the other two-thirds being payable for lease of the land and for water for irrigation. A similar system is capable of being evolved for the establishment of economic holdings in the dry zone of Ceylon. The original area (4 acres suggested) is thought to be the maximum that could be handled satisfactorily by one family. It has been found that an individual can grow satisfactorily two acres of cotton in addition to his usual chena or paddy cultivations. Stumping in the second year is more difficult than in subsequent

years after clearing. One acre is the average that could be stumped in that year, but in subsequent years $1\frac{1}{2}$ acres annually should be easily possible. It could be arranged if this stumping is done systematically that the ploughing of such lands could be done commercially, but the ultimate aim should be for each holder to have at least one pair of bulls for his own individual use and one cow. As the work progressed so would additional areas of land be given out at probably 2 acres per annum, until the complete area of the holding is provided and brought under systematic cultivation.

The experimental work has progressed sufficiently to warrant trials being made with a scheme such as is outlined above. It is likely to be the most successful in areas where the population is reasonably progressive and where is some pressure for land. The promise of holdings of an economic size in individual ownership will meet with the necessary response and if it is made clear that such holdings and their equipment can only be secured on the result of progressive labour good work may be relied upon and satisfactory results secured.

The necessity for improving the conditions of the growers in the Dry Zones of the Colony is an important one. Permanent improvement cannot for all time rest upon the shifting cultivation of the chena. The provision of holdings of an uneconomic size is unsound, and it is only when a system of dry land cultivation on holdings of an economic size with their proper equipment of cattle and implement that the basis of a sound agriculture for these areas will have been laid. The above recommendations are based on the understanding that paddy lands are not available. With the holdings of paddy lands, the areas required per cultivator for dry-land cultivation are proportionately less, but if such areas are to be cultivated with ploughs and implements such areas should not be less than 7 to 10 acres if they are to be economically sound.

Discussion.

His Excellency the Governor said that they were very much indebted to Mr. Stockdale for his paper and also for his experiments, the results of which he recorded that day. The work Mr. Stockdale had been engaged in, was of incalculable importance to the country generally and especially to their fellow countrymen in the Dry Zone. He felt that if the experiments were attended with success, a very distinct step forward would have been taken in solving one of the difficulties which were simply disheartening to one who saw such wealth in Ceylon and at the same time a large proportion of the people living in such poverty in the jungle areas of the Dry Zone. He hoped that every encouragement would be given to Mr. Stockdale in his experiments so as to enable him to carry them to a successful issue. He (the speaker) did not propose to discuss in any detail the results which Mr. Stockdale had described to them of his experience of the various crops. Mr. Stockdale had not referred to a plant which he expected he would have, and that was

the sunflower, of which he had experience in other countries. It might be that the climate of Ceylon was not suitable for the sunflower seed. If it were, he thought that the cultivation of the sunflower for its seed would be profitable as a minor product. There was a ready market in England for sunflower seed. It was largely used as food for parrots, who in their cages impart so much of solace to the declining years of lonely maiden ladies. It was also used for many other less romantic purposes. He was interested and glad to hear that the question of the rotation of crops in the dry zone was receiving the attention of the Director of Agriculture and the officers of the Department. In considering the needs of the Dry Zone, they should not overlook the needs of the Wet Zone. At the last Conference Sir Hugh Clifford had submitted very important proposals. These were submitted to the Finance Committee. As far as he was concerned, he felt great sympathy with the objects Sir Hugh Clifford had in view. He (the speaker) did not propose to say anything about the proposals in detail, partly because he did not know much about the subject, and partly because the matter was under the consideration of the Land Commission whose recommendations he would like to await before he attempted to form any opinion of his own. But he hoped that while they were considering the obvious needs of the Dry Zone the needs of the inhabitants of the Wet Zone would not be overlooked. He (the speaker) thought that some of those present there who were conversant with the conditions in the Dry Zone would throw some light on the very interesting paper that was read.

Mr. J. H. Meedeniya, Adigar, said: I have visited almost all the important centres in the Dry Zone in all the Provinces in the Island during the last 10 years. I find there are excellently suitable lands for paddy cultivation both under the tank areas as well as the other Irrigation schemes, such as the Walawa Ganga Scheme. These lands are not only suitable for Paddy cultivation but also good for cultivation of crops, such as Indian Corn, Chillies, Peas, Onion, Corriander, in fact all those other ingridients which grow in South-India.

Both Tobacco and Cotton grow well, lime and oranges too thrive well. There are excellent pasture lands with plenty of good grass and water, for cattle breeding.

During the period of the rice crisis in 1922, a large number of acreages were taken from Government in the Dry Zone for Paddy cultivation by syndicates and by one or two leading individuals, amongst these about 9,000 acres at Minnèriya was taken by an European Firm, a channel about eight miles was cut from the tank, and a cart road was partly opened but they had to abandon it owing to Malaria and the inability to get labour. I visited this land during those days. It is flat as a table and suitable for the cultivation of all the products mentioned above. It is an ideal place for cattle breeding. Both buffalos and neat cattle there are usually bigger than those found elsewhere in the Island. At present lean cattle are sent there to graze before they are slaughtered.

During the year 1922, I along with Mr. M. G. Perera took 500 acres at Ambilipitiya Village for paddy cultivation; this too is situated in the dry zone, and is a well known Malarial district. We have with great difficulty owing to malaria cultivated paddy about a hundred and seventy-five acres. The villagers too followed us and cultivated very nearly 60 acres, taking about 2 to 5 acres each. I have planted as an experiment cotton, tobacco, onions, chillies, etc., and find excellent results; unfortunately I could not have done better as it is very hard to gea labour. I have planted a few orange and lime trees, and they bear such large quantities of fruit, that I have got to keep the trees up with supports during the season for fear the branches would give way. I find through experience that malaria decreases its virulence 2 or 3 years after the opening of lands. If by some means we could only

develop and bring into cutilvation these irrigable lands we will not have to depend on India for rice and other sundry products, besides we will then have plenty of splendid cattle.

The only trouble being malaria, is the difficulty of getting any labour.

I think it is advisible to start cultivating centres near about Railway Stations with a Dispensary and an Officer from the Co-operative Credit Society to buy and sell the produce as it is being done for cotton by the Director of Agriculture. I would suggest the appointment of a small committee of experienced gentlemen to be associated with the Hon. the Director of Agriculture to visit some of the important places and to recommend to Government some feasible scheme to develop these tank areas.

Mr. Lester Smith bore out the remarks of Mr. Stockdale with regard to the promising nature of Kapok, as well as cotton and other money crops. As was only natural, he said, in the preliminary stages of such experiments there had been failures. This was bound to occur with variations of climate and with indefinite ideas as to the correct seasons for cultivation and different crops were tried. It was hoped that some definite form of rotation would eventually be evolved. He thought that very promising results should be forthcoming on cotton, cereals, and leguminous crops. With regard to His Excellency's suggestion about sunflowers, he said that he had been able to establish some sunflowers at the Bata-ata Station. There was about an acre at present under cultivation.

Mr. J. P. Obeyesekere said that it seemed to him that there were two difficulties in the way of the cultivator: (1) the difficulty of cattle, (2) in the bad season there was nothing to fall back on. About 30 years ago they started work under an Irrigation Scheme in a place where people were scarce and stricken with parangi and malaria. After 30 years they had about 200 acres under paddy. They did not take labour from healthy districts but employed the people in the villages themselves who were fairly immune from the disease. They helped them to cultivate a certain area and as the Director had said they put by paddy. When the bad season came they fell back on it and in that way parangi disappeared and there was quite a healthy people. This was in Sabaragamuwa. In the same way if people in the district itself and from neighbouring villages were utilized and barns put up and paddy collected for the adverse seasons, he thought it would be very much easier and there would be less loss of life and more land opened.

A Member of the Conference enquired how the Maha Ilupalama Hemp plantation came to be closed down.

Mr. Stockdale said that it was a capitalist undertaking of a fairly large area. They did not have a sufficiently large area under cultivation to make it economic to continue cultivation.

Mr. A. T. H. De Silva enquired whether the same facilities in the matter of providing the necessary machinery to the Rambewa Co-operative Society could not be extended to the Mihintale Co-operative Society which the speaker had the pleasure of organizing. He (the speaker) suggested that coconuts could be planted with advantage on the banks of the tanks in the North-Central Province.

Mr. Stockdale replied that the request of Mr. De Silva was rather late. Continuing he said: " We are going to try two experiments. We are not prepared to say definitely that those experiments are going to be successful, but everything indicates that they will be, and it was decided that we should start two, one in the North-Central Province and another in the Hambantota District. The position is Government has undertaken to erect two experimental mills in these two places. The cost of the mill is to be considered in the first instance as a loan, so that after a period of 5 to 6 years, it is hoped

that they would have obtained sufficient profit to themselves to pay the whole cost of the mill, and at the same time the cultivators would be able to sell their leaves. The price at which we have arranged to work is 25 cents per 100 leaves and until those experiments have run for a few years, I would not like to make any definite promise to extend them. But if the Mihintale Society can in any way get together a certain amount of capital then I would be very pleased to consider any proposal that they might put up and see whether something can be done in that direction."

MR. BRAYNE asked how, in regard to sisal hemp, a Co-operative Society worked. With regard to the rotation crops, was it practicable to grow two crops a year in the dry season ? Was manure necessary to make the replacement successful ? With regard to the difficulty of stumping, had monkey-jacks been tried ? Was the castor-oil plant a crop that could be used and could plantains be brought into the rotation ?

MR. STOCKDALE said that the total cost of the installation of a sisal mill was about Rs. 7,500, but they expected that in the Ranbewe experiment they could cut it down to Rs. 6,000 or a little more. The actual cost of the machine was Rs. 600. Then there was the question of the engine for running and a shed to cover the engine and the machinery. There were also washing tanks required. With regard to the growing of two crops in one year, the dry season varied from district to district. In certain areas one could get a "Yala" crop in addition to the "Maha" crop and there was no reason why two crops should not be obtained provided the rainfall was adequate. In the Hambantota District it was usual to grow only the " Maha " crop, but from the rainfall figures it seems possible that a " Yala " crop of gingelly could also be grown. They were trying that experiment on the rotation stations. If there was slight rains in the early monsoon two crops were quite possible.

With regard to plantains, one had to be assured of the sale of the produce. It was a useful crop if one could get a sale but in many areas in the dry season it could not be grown and in certain areas it was too dry without irrigation. It was again a question of the district one was in.

Castor-oil could easily be grown in places, but it was not very profitable.

Stumping was the most serious problem they had to face, but he believed stumping could be carried on from what he had seen in Hatagala in the Hambantota District, where there was a keen demand from the villager to possess his land, he would manage to get the stumps out. Where there was no land hunger, the cultivator would naturally look to an easier form of cultivation and he would not willingly undertake this laborious question of stumping. But in one of their Experimental Stations, they had been able to stump in the second year at a cost of less than Rs. 40 an acre. From what he had seen in the Hambantota District, stumping out was within the possibility of the individual owner. They had not tried jacks yet. Unless one had trained labour available it was difficult to get good work from jacks. He thought one should be very cautious before introducing jacks, which was unknown to the Ceylon cultivator. He would find some difficulty in handling them.

MR. BRAYNE remarked that Mr. Stockdale seemed to be sceptical of the villager's ability to use jacks. The villager, he thought, was quite intelligent enough to use them.

SIR SOLOMON DIAS BANDARANAYAKE corroborated what Mr. Brayne had said about the use of monkey-jacks. He imported one from England and had all the stumps taken out over an extent of 50 acres of land which was now

under cultivation. The ordinary villager was quite competent to work the jack and take the stumps out, but it was not a case of stumping only.

MR. COOKE said that in the North-Central Province the village device was to burn the stump on the spot. It saved labour.

MR. BRAYNE.—How long is it left to dry before it is burned ?

MR. COOKE.—Third, fourth or fifth year.

HIS EXCELLENCY wound up the discussion by wishing Mr. Stockdale all possible success in his efforts and expressing the hope that they would result in lasting benefit to the people.

MR. STOCKDALE.—Before we closed yesterday His Excellency suggested that we might appoint a Committee of this Conference to consider the question of paddy cultivation in its various aspects. I considered that with His Excellency this morning, and I propose now to move a resolution that the Food Products Committee of the Board of Agriculture together with members of this Conference who are specially interested in paddy cultivation shall go into this matter. With your permission, I therefore move the following resolution :—

> " Be it resolved by this Conference that the Food Products Committee of the Board of Agriculture do make with the least possible delay a detailed investigation of the present conditions of the paddy industry and make suggestions for its improvement; and that this Committee be requested to co-opt for the purpose of this enquiry other gentlemen specially interested in the product.'

I have, therefore, much pleasure in presenting that resolution to this Conference and it is our intention that this Committee should go into the matter during the next year and shall report its suggestions to the conference proposed to be held next year.

GATE MUDALIYAR A. E. RAJAPAKSE seconded.

MR. A. GODAMUNE said that if he might be allowed to suggest any names, he would propose Messrs. F. Taldena, J. H. Meedeniya, Adigar, Harry Ellawala, T. B. Bulankulama, R.M., T. B. L. Moonemalle, J. C. Ratwatte, Dissawe, R. B. Nugawela, Dissawe, and K. B. Beddawela.

HIS EXCELLENCY THE GOVERNOR said that those who wished to suggest any names should send them to Mr. Stockdale.

The resolution was then put to the House and carried unanimously.

HIS EXCELLENCY added.—The suggestion put forward by Mr. Meedeniya, Adigar, regarding visits to development areas may also be referred to that Committee.

Close of Conference.

HIS EXCELLENCY THE GOVERNOR.—We have come to the end of our deliberations. The hour is late and though I see I am put down as an item on the programme, I shall make my closing remarks very short. We have listened to a great deal of eloquence and to a great deal of interesting matter, and even if I had the time, it would not be in my power to add anything of substantial interest to what has been said already. I will not attempt anything like a survey of the ground which has been covered by this conference as time will not permit and I am really not competent to do so. Nor, will I attempt to

single out anyone or two of the subjects which have been discussed for special mention now. I think all the discussions have been of such interest that it will be invidious to mention anyone or two. I will give with your permission before I go, one or two thoughts. The first conclusion which has formed itself in my mind—of course there is nothing novel in it—is that our discussion has emphasised even more clearly than we were aware of, the need for close co-operation between the scientific and the practical side of agriculture, and the very great need of the application of science in all its forms and especially scientific research to agriculture in every aspect. There is the agriculture of the village cultivator and the agriculture which is carried on by the large capitalist Companies on tea or rubber estates. They have all problems which have to be considered and solved and the only fruitful way of doing that is by the application of scientific methods which could be evolved from research, and therefore, I feel sure that a meeting of this kind would strengthen the hands of those who are concerned in the important subject of research and it will be an encouragement to Mr. Stockdale and his officers to carry on with even renewed vigour the admirable work they are doing. The other point which has impressed itself upon my mind—I have been thinking of it before for some time—is the importance of co-ordination of efforts in approaching the question of agriculture. We were glad to have at our meetings with us the Conservator of Forests and the Head of the Veterinary Department. I wish we could also have had the Director of Irrigation and I would have also wished to have had Mr. Campbell who deals with Co-operation to take part in our discussions. I do feel it is essential in the interests of the country that there should be the closest possible co-operation and the greatest possible co-ordination between the activities of the various departments which all in one way or another are aiming towards the development of the resources of the soil, whether it was through agriculture proper or through animal husbandry or through Forestry or irrigation or through Co-operation. The object for which they are all working is one and the same and the more we can enable them to work together and give each to the other the benefit of its experience and knowledge thus to combine for the elaboration of the common policy applicable to and carried out by all, the more likely we are to achieve the satisfactory results which we all hope for. I am not suggesting that there is at present any lack of co-operation or co-ordination. Nothing in this world is so perfect which could not be improved, and I think it is desirable that we who are responsible for the administration of the Island should make every effort to draw ever closer the bonds of co-operation and co-ordination which bind together these various agencies for the improvement of agricultural resources of the country. I have

not worked out any detailed scheme as to how best this could be done. I am not even sure whether the time has come for such a scheme. Before very long we shall have the recommendations of the Lord Donoughmore Commission for the future constitution of this Colony and not being able to foresee what kind of constitution we would have to work with in the future, it will be hardly practicable to devise new machinery which might or might not fit into the new constitution. But whatever constitution we have, the object we have to achieve in this respect is the same though the precise machinery may vary in detail.

In conclusion, I must thank you for the support which you have given me in the chair, and I have to thank you also for the opportunity you have given me to hear these very interesting and important discussions. We have dealt with matters of vital significance to the whole country. There is nothing more vital to this country than agriculture. Agriculture, as I said before, touches the national life and touches the activities of the Government at every point. We have heard to-day how important sanitary and medical works are in regard to the settlement of people on the land and one can extend the list of overlappings and interlocking almost indefinitely. I am glad that we have been able to meet here. I am particularly glad that we have met at Peradeniya where we have such abundant evidence of the good work done by the Agricultural Department and its officers. Peradeniya is a place in which as Governor of the Island I take a special pride. There is no ambition nearer or dearer to my heart than to see Peradeniya expanding to be yet more important in the life of the country and far more important in the life of the Empire. With these few words I thank you again for your kindness to me and I hope that you as well as I have derived not only pleasure but also profit from these discussions. I shall look forward to meeting you all again at the next Conference if you be again good enough to ask me to take the chair.

The Director of Agriculture.—Your Excellency, before we disperse, on behalf of those who have found it possible to attend this conference, and particularly on behalf of the officers of the Agricultural Department, I would thank you again, Sir, for so kindly coming here and presiding over all our deliberations. Your presence in the chair has added to the material value of the conference because it has shown to us the real keen interest that you take in the work we are attempting to do, and everyone who attended this conference has desired me to thank you for giving so much of your time in presiding over our deliberations. On behalf of the Conference I would wish to convey to you our most heartfelt thanks for undertaking to preside over all our sessions.